

# technology review

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# PHOTOGRAPH OF CORONA

BY

HARRISON W. SMITH

'Ten Seconds' Exposure. Enlarged to twice the diameter

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No. 3

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## THE M. I. T. ECLIPSE EXPEDITION TO WASHINGTON, GA.

In the fall of 1899 the Corporation of the Massachusetts Institute of Technology made an appropriation from the Austin Fund to send a small party to observe the total solar eclipse of May 28, 1900.

The equipment of the Geodetic Observatory of the Civil Engineering Department was quite sufficient for the observations of local time, latitude, and longitude. By adding to this equipment two equatorially mounted telescopes, the party was furnished with all necessary instruments for the determination of the times of the four contacts; and nothing beyond this was originally contemplated.

During the fall term of 1899 a careful study was made of the track of the moon's shadow plotted on the best maps, searching on the central line for the town of highest altitude and of easiest approach. The little city of Washington, Ga., seemed to fulfil the conditions. On consulting the pamphlet and diagram prepared by Professor Frank H. Bigelow, from meteorological observations taken during the past three years along the path of the eclipse, it was found that, although the place itself was not mentioned, the region was one most favorably situated with reference to probable cloudiness. Immediately correspond-



ence was begun with the local postmaster. Fortunately for our party, the postmaster, Mr. J. E. Poché, proved to be a man among a thousand,—one who appreciated our work and heartily assisted us from the beginning to the end of our undertaking. It was from him that we learned that the little city was supplied with good modern hotels, and was “a centre of culture and refinement.” We were sceptics, however, and did not believe until by actual experience we found the promises more than fulfilled by the reality.

The party was placed in charge of the writer, and at first Professor Arthur G. Robbins and Mr. George L. Hosmer were the only other members. Later our number was increased by the addition of three volunteer observers,—Professor Dana P. Bartlett, Mr. Walter Humphreys, and Mr. Harrison W. Smith, all from the Institute. These new men made it possible to extend the programme of work, and to make it include magnetic observations and the sketching and photographing of the corona. None of the Tech party could properly be termed astronomers, and no new line of research work was deemed advisable.

In April, Mr. J. Rayner Edmands (M. I. T., '69) of the Harvard College Observatory, went South to look over the place selected by the Harvard eclipse party in Greenville, Ala. Mr. Edmands very generously offered to look in on Washington, Ga., on his way South, to sample the hotels and look about for a favorable site for our instruments. Soon there came an assurance from Mr. Edmands that “we had landed on our feet” in selecting Washington. Later there came a transfer of Harvard, Blue Hill, and Flagstaff parties to this point. The last arrangement was a happy one, beneficial to all concerned.

By the first week in May the new equatorials of five and

three inches' aperture, ordered from the firm of Alvan Clark & Sons, Cambridge, were completed. These telescopes were fitted with eye-pieces and shades especially devised for eclipse work by Mr. Lundin, and proved most satisfactory in every way.



A Typical Residence, Washington, Ga.

On May 9 the writer sailed from Boston on the Savannah steamer, which had on board the outfit of the Harvard, Blue Hill, and Technology parties. The largest part of the freight was the box containing the cluster of cameras for Harvard's intra-mercurial research. This was later to have a house built about it and to be mounted equatorially. On arrival in Savannah it was found that the freight just filled

a large box car, and here it became evident to the writer that some kinds of freight even more than tourists needed to be "personally conducted." In spite of "smashers" and railroad wars, it finally landed safely in the Washington, Ga., depot.

Washington, Ga. ! It is now a name to conjure with !



City Square.

The little mule-car that hauls you from the depot to the hotel prepares you for something quaint and picturesque ; but the picturesqueness is dispelled on entering the brand-new hotel, with its electric lights, its baths and large airy rooms, to be restored when you look from the windows on the City Square with its old court-house and the crowd of jet black negroes with their nondescript mule teams. You

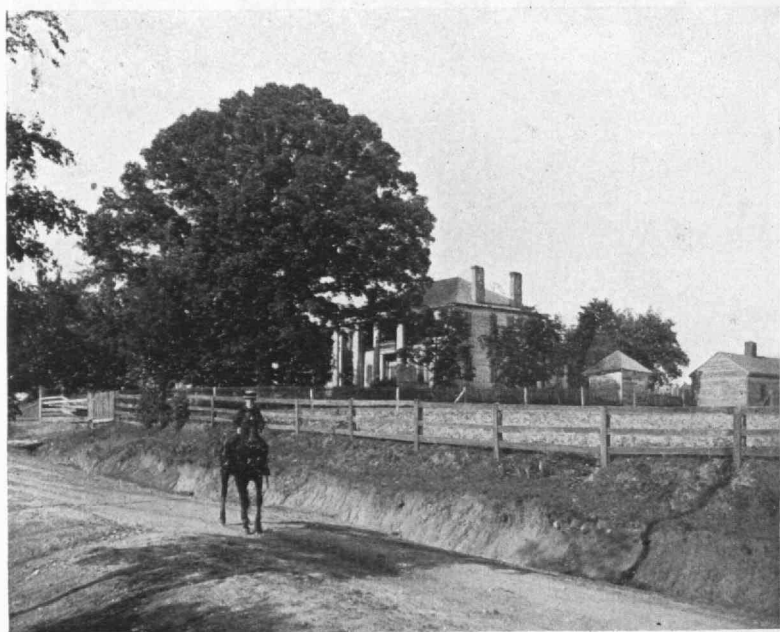
take a stroll about the town, and you learn that the place is rich with historical associations. On all sides are the great magnolia-trees in full bloom, gardens running over with rose-bushes, shaded walks and drives leading to stately old mansions surrounded by colonnades reaching to the eaves.



“Colonnades to the Eaves.”

After a while you begin to ask questions, and wonder why you have not known of this town before. The answers to your questions gradually make things clear. This town has long been the abiding-place of the best blood in Georgia. It is the heart of the old Confederacy. It is here their great leaders were born, and it is here they came

back to live in the days following the war. The old town, uninjured materially by the actual struggle, offered the balm of repose and serenity. No tourists came here, and no curious tourists were desired. But the contrasts! The very new stores, the electric lights in the shop windows, the telephone, all give a check to sentimentalizing. Now is



On the Road to the Eclipse Station.

the day of the new generation without war memories. The hotel is the growth of the present year. It is not long that the Square has been sprinkled from the hydrant, and to-day they are laying the first sewer pipes in the streets. It has not, however, the "hustle" of the Western town. The darkies dig the sewer ditch to a drawling tune, and no hasty shovel or pick mars the rhythm of the movement.

Here is the home of General Robert Toombs, who would not have a hotel built in the place as long as he lived, who said, "If any respectable stranger comes to this town, he is welcome to my home; and, if he is not respectable, we do not want him." Close at hand Alexander H. Stephens was born. You hear many interesting anecdotes of these



Where Jefferson Davis held his Last Cabinet Meeting.

leaders, and those who still bear their names are not a few. Here Jefferson Davis held his last cabinet meeting. The town may be said to have been the birthplace and death-bed of the Confederacy. The town is very old, and was named for General Washington before the site of the capital in the District of Columbia was selected.

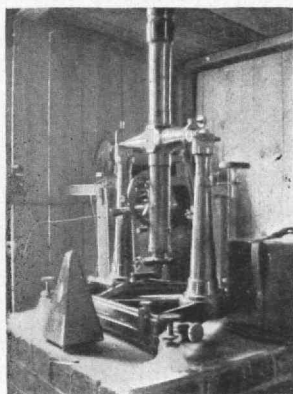
Nothing could exceed the generous welcome which these

warm-hearted Southerners extended to the little Yankee party of eclipse seekers. It would be out of the question to think of telling of the eclipse without some preface about the people and the place.

The site selected by Mr. Edmands was certainly the best to be found, and on the first day after arrival the ground was staked out for the location of buildings and instruments. An observation on Polaris gave the north and south line for orienting the piers and buildings. The brick and cement pier for the astronomical transit and the building for the Harvard big camera were well advanced before other arrivals from the North reached Washington. Mr. W. H. Attwill, of the Harvard party, was the first to come and get to work. His heroic struggles with "Jumbo," as the big camera was called, are a matter of town history now. Next to arrive was the representative of the Boston press, Mr. William H. Hills of the *Globe*, accompanied by his wife. They proved to be a most pleasant and congenial addition. Then followed Professor W. H. Pickering of Harvard and Mr. George L. Hosmer of the Institute of Technology. The preparations went steadily on from the first day, and each one seemed to be on hand at the right time for his special work. Mr. Hosmer began the adjustment of the astronomical transit, and soon we knew the latitude and the local time to a fine point. A wire was put up connecting the observatory with the Western Union Station in the town, and then the ticks of the astronomical clock in Washington were received on the spot. The local sidereal time recorded on our chronograph and the time signal from Washington, D.C., enabled us to compute the longitude. We knew that the maps of this part of Georgia were not controlled by triangulation, and it was not to be expected that the latitude and longitude of the town could



be accurately scaled from the map; but we hoped that they were somewhere near right. The only way was to make an independent examination, and then, if necessary, to revise the figures for the predicted times of contacts and for the period of totality. From maps the latitude of Washington, Ga., was found to be N.  $33^{\circ} 40'$  and the longitude W.  $82^{\circ} 42'$ , or five hours, thirty minutes, forty-eight seconds. By direct observation the latitude was found to be N.  $33^{\circ} 43' 49''$ , and the longitude obtained by means of



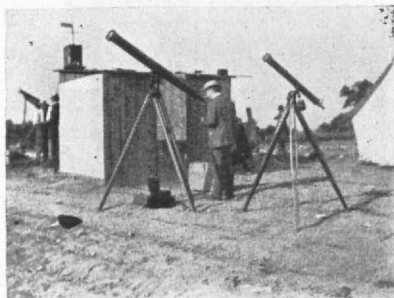
Astronomical Transit.

the time signal was W. five hours, thirty minutes, fifty-six and two-tenths seconds. This moved the station over four miles north and nearly two miles west. We were sorry to find this change, as it carried us off the central line and reduced the period of totality about two seconds. We had to make the best of it: two precious seconds were lost. The times of the contacts were recalculated, and we knew where we were and when to expect the eclipse.

During the week before the eclipse we erected a second small brick pier to mark permanently the north and south



line. This was done for the benefit of local surveyors in Washington, Ga.; and we made a small map showing the location of the piers and all the instruments with reference to the nearest road and house. We also observed the dip and declination of the magnetic needle. Mr. Hosmer and the writer were fairly well occupied both day and evening. While Mr. Hosmer made the time and latitude observations, it was often found expedient to divert the visitors (who were always with us) from the vicinity of the more delicate instruments. Therefore, in another part of the cotton field was set up one of the equatorials; and the



Equatorials.

visitors were entertained by showing them the crescent of the planet Venus and the moons about Jupiter.

On Tuesday, May 22, all of the Northerners who had arrived were invited to a very pleasant afternoon tea given by the ladies of the Frank Willis Literary Club. The gentleman for whom this club was named was the local philanthropist, and to him is due the excellent public library which the city possesses.

Professor Pickering gave two popular lectures on the eclipse,—one before the literary club and one at the high school,—and enlisted some twenty assistants to work his many cameras.

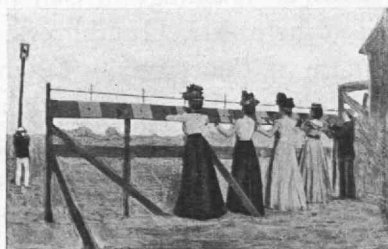
On Saturday, the 26th, the astronomers began to assemble in good earnest. Mr. A. Lawrence Rotch and Mr. Ferguson, of the Blue Hill Observatory; Mr. A. E. Douglass, of the Flagstaff Observatory; Mr. J. Rayner Edmands and Rev. Mr. Saville, from Cambridge; Professor Arthur G. Robbins, Professor Dana P. Bartlett, and Messrs. Humphreys and Smith, from Technology,—all came on that day. In the evening Mrs. W. H. Pickering, Miss Russell, and Miss Michaelis, from Cambridge, arrived. That night the Hotel Fitzpatrick wore quite a New England aspect.

Five young ladies of Washington, Ga., skilled in drawing, were enlisted to help Mr. Humphreys and the writer in sketching the form of the corona. Teachers and pupils of the high school to the number of twenty had volunteered their services to Professor Pickering. These latter assistants, together with the regular corps of observers, made a little army that had to be drilled several times before the critical moment, as all success in eclipse work must depend upon every one knowing, without question, exactly what he is to do and when he is to do it.

At the grounds of the Catholic Orphanage and Seminary another group of astronomers was gathering,—Father Charropin and Professor Frumveller, of St. Louis; Father Rigge, of Omaha; and Professor Quinlan, of Cincinnati.

Sunday, May 27, was the busiest day. Even those of our party who always went to church before forgot to go this morning. To minds filled with scientific enthusiasm Sunday was simply the day before the eclipse. Ropes were stretched around our corner of the cotton-field, and few visitors were admitted within. The sketchers now received some practice as nearly under the expected conditions as possible. A word about our sketching-class. On

the sketching-stand, erected days before, there was tacked to an inclined board the paper, already supplied with the black disk for the moon, together with vertical and horizontal lines and concentric circles to aid in estimating distances. Above the upper edge of this board was stretched a horizontal wire, and short vertical wires crossed this one in front of each sketcher. The practice consisted in drawing from various diagrams of the corona held up on the end of a pole, so as to appear at about the proper angular elevation for the sun. The time of sketching was regulated by calling out the seconds to the number of eighty-five. The



Sketching Class.

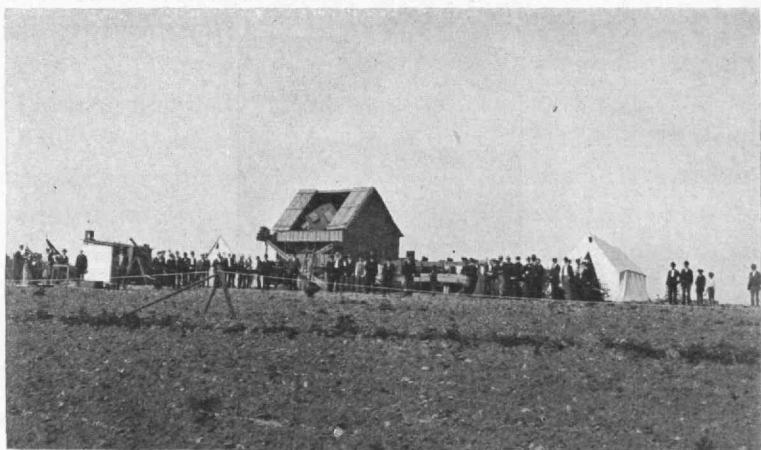
young ladies were asked to sketch each a single quadrant. Mr. Humphreys and the writer had practised a little longer, and attempted the whole corona.

The idea of sketching was to try to show the impression made by the coronal light on the eye, as distinct from the impression made on the photographic plate. To those who have carefully watched the corona, the photographs have always seemed unsatisfactory; sketches, perhaps even more so, but in an entirely different way. Photography of such a light, gauzy thing as the corona is different from other kinds of photography.

All observers and their assistants were drilled to-day in

their several duties to the counting of the strokes of the metronome by Professor Robbins. White sheets were spread upon the ground and tacked to the side of a building for observing and photographing, if possible, the elusive "shadow bands." Meteorological instruments were set up, and began recording automatically the elements of the weather.

During the afternoon a telegram of prediction came from



General View of Eclipse Station.

the Weather Bureau, worded in language to suit the most optimistic.

As night approached, the plate-holders had to be filled. By eleven o'clock nearly everything was ready, and a night watchman was hired to remain on the ground and keep awake until five in the morning. Most of the parties retired then to the hotel. That night some slept five hours, some two hours, and some half an hour. At five o'clock next morning a few were back on the cotton-field. At half-past six the field was well peopled, and all was in readiness.

At seven hours, two minutes, twenty-two and seven-tenths seconds local mean time, Mr. Hosmer, looking through the large equatorial, silently recorded on the revolving chronograph the first contact. Six and three-tenths seconds earlier Professor Robbins, with the small equatorial and a stop watch set to the local mean time chronometer, had observed independently the same event. The eclipse was on! The sky was clear beyond the wildest hopes! Every one was cheerful.



Magnetometer.

The hour before totality was used for the final drill. Kodak fiends now got in their work on the absorbed groups. Professor Bartlett began observing and recording the readings of the magnetometer, the object being to determine whether any changes in magnetic declination would occur during the progress of the eclipse. Smoked glass was freely used. The crescent images of the sun were watched as they fell on the ground between the shadows of the interlaced fingers. The cotton-field not furnishing trees to illustrate this well-known phenomenon, we had to be contented with producing the effect by personal effort.

When the time arrived, "Twenty minutes before totality" was announced, and the uncanny darkness of the sky began to be felt. At "Ten minutes before totality" there was a tendency to speak of the chilliness, and there arose a very slight breeze. Those nervously sensitive felt much more of a chill than the cold-blooded thermometer would justify, the entire drop not being more than five degrees. At "Five minutes before totality" those who were going to sketch took their places behind the sketching-stand, and closed their eyes, not to open them until they heard Professor Robbins counting the first "One" of the seconds. These moments of waiting seemed the longest of the day. There was a general hush of expectancy, and Professor Pickering's announcement of "The Shadow" was the first word to interrupt the quiet. Then the call was given to the shadow-band observers, and almost immediately a loud, clear voice was heard counting "One — two — three."

My eyes opened on a view for which they had been prepared; but the beauty of the spectacle kept the sketching pencil unemployed for several seconds. At first there seemed to be but two broad streams of light, with very sharply defined and nearly parallel edges, extending — the one upward and to the right, the other downward and to the left — from a jet black disk, all against a background of dark blue sky. The polar streamers were not noticeable to the naked eye at the first glance, so strikingly brilliant were the equatorial rays. There was the faintest tinge of lavender in the light of the corona, and the inner contour of brightness was fairly well marked at the upper side. There was plenty of light for sketching. Aside from the voice calling the numbers, there were no sounds now but the scratching of the pencils and the mechanical clicks of the different pieces of apparatus. "Eighty-five — eighty-

six." It was over. If you had done the thing you ought not to have done or had left undone the thing that you ought to have done, it was too late now for anything but confession.

As far as we could tell at the time, all of our little party had done what they had planned to do. Mr. Harrison W. Smith, with his camera, had made six exposures of different lengths of time. He was assisted in this work by Mr. Irving M. Callaway, a Washington young man. Mr. Smith's ingenious device for following with the camera the motion of the sun needs special mention. Below is given his written description of the instrument, accompanied by a photograph.\*

At thirteen minutes after totality a brief cablegram was sent by Mr. A. E. Douglass, of the Flagstaff (Ariz.) Observatory, to Mr. Percival Lowell in Tripoli, Africa:—

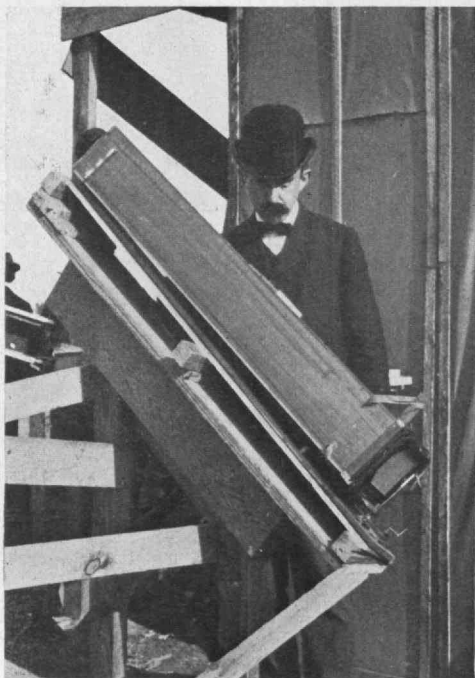
DAIX, TRIPOLI, AFRICA.—Corona similar 1889. Shadow bands, biograph and small cameras entirely satisfactory, moon's shadow visible on sky.

DOUGLASS.

This cablegram left the cotton-field over our telephone wire to the Western Union Telegraph Station in Washington, Ga., at eight hours, twenty-four minutes A.M. local time,

\*The camera with which the photographs of the corona were taken consisted of a wooden box, with the reversible back of an ordinary 4 x 5 camera attached at one end and the lens at the other. The lens was borrowed from a small telescope, and had an aperture of three inches and focal length of forty-three inches. In order to make the long exposure, it was necessary to provide some means of following the motion of the sun; and this was accomplished by mounting the lens end of the camera on hinges and supporting the other end on a tangent screw. The base of the camera was securely mounted on posts, as shown in the photograph, being tilted so that the plane of motion of the camera about the hinged end should be parallel to the plane of the earth's equator. The tangent screw was operated through a series of gear-wheels, by means of a small crank, shown in the photograph at the lower end of the base of the camera. The ratio of the gear and the pitch of the tangent screw were such that one-half a revolution of the crank would cause the camera to rotate through an angle of fifteen seconds. Consequently, by rotating the crank at the rate of one-half revolution each second, the desired result was obtained. It was found that, by following the beats of the metronome pendulum or listening to the counter, the driving could be made sufficiently uniform by hand. The plate was protected from reflection from the inside of the camera box by means of a series of screens distributed along the inside.

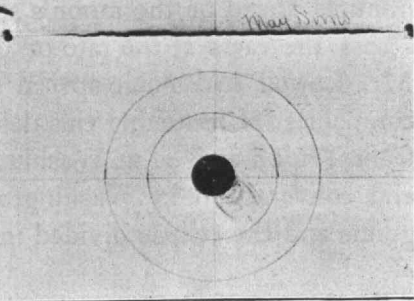
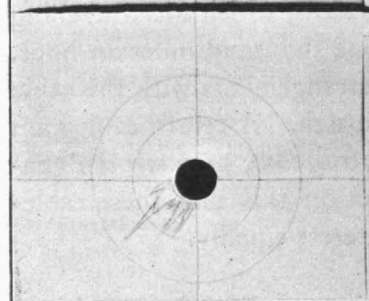
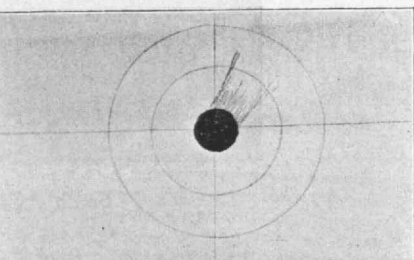
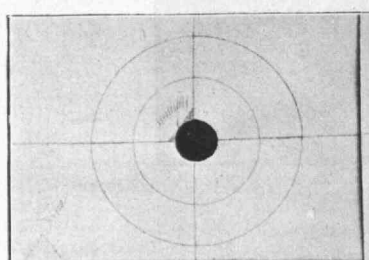
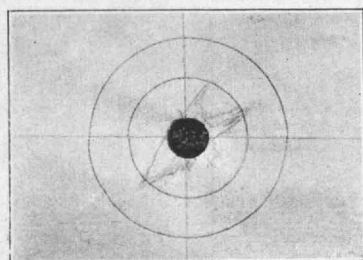
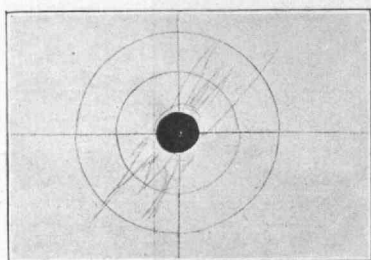
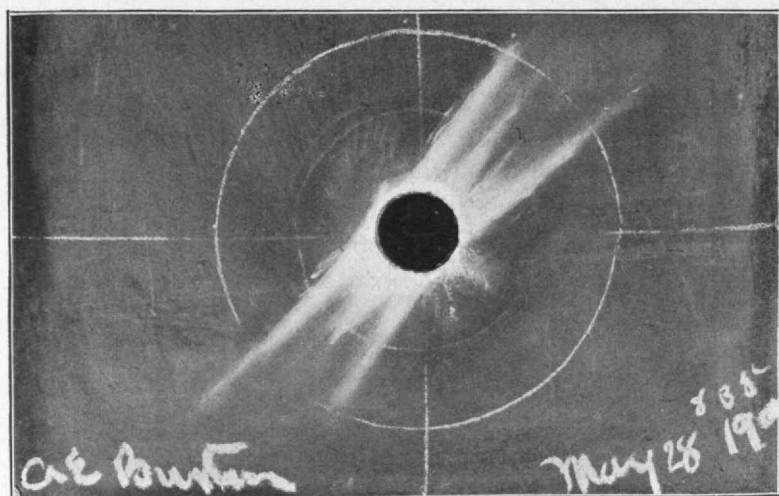
at one hour, fifty-five minutes Greenwich mean time. It was received by Mr. Lowell in Tripoli at two hours and five minutes Greenwich mean time. The actual time of transmission of this message from one man to the other was ten minutes. It arrived in Tripoli two hours and thirty



Smith's Camera.

minutes ahead of the moon's shadow, which was travelling across the earth at the rate of one thousand miles an hour. Mr. Lowell had made special arrangements with the cable companies for hastening this despatch. A return cablegram from Tripoli arrived at Washington, Ga., 11 P.M. In general conversation in Washington on this day, these cablegrams and the eclipse divided interest equally.





Composite Sketch and Sketches made during Totality.

Twenty-four minutes after totality the writer finished a pastel memory sketch of the corona; and this and all the sketches finished during the period of totality were then sealed up, and remained untouched until photographed in Boston.

Professor Robbins and Mr. Hosmer made the last scien-



Georgia Barbecue: Roasting the Animals.

tific record of the day, the time of fourth contact. Below are given the figures from the chronograph sheets for all the four contacts in local mean time: first contact, 7 hours, 2 minutes, 22.7 seconds; second contact, 8 hours, 9 minutes, 52.0 seconds; third contact, 8 hours, 11 minutes, 18.2 seconds; fourth contact, 9 hours, 28 minutes, 26.9 seconds.

At fourth contact the eclipse is over! All are happy, and seek the hotel for breakfast.

Now there seemed nothing to do but to pack up and leave for home. No, we were reckoning without our hosts. The ladies and gentlemen of Washington had arranged a barbecue in our special honor. Every eclipse seeker was invited. All had heard of a "Georgia barbecue," or, rather, a Georgia "cue"; but few had experienced one. The meat



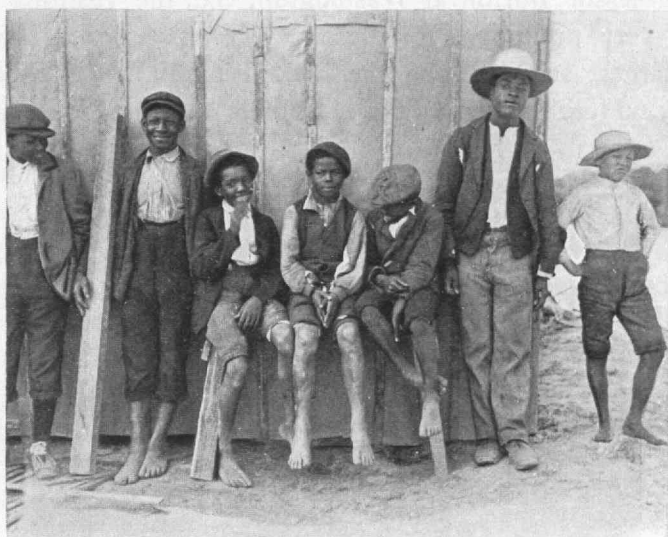
The Barbecue: Just before Dinner.

roasted to a savory crisp over the pit of live coals, the hotly spiced "Brunswick stew," served under the trees in the midst of pleasant company, will be a memory long to survive. The *chef* of the "cue" was the jolly sheriff of the town, whose very appearance was a guarantee of connoisseurship in things edible. The "cue" formed a fitting climax to a most pleasant trip; and on Tuesday afternoon the "Tech" party started North, feeling, as our expert in photography expressed it, "what a pity it

was that eclipses never struck the same place twice in a fellow's lifetime."

ALFRED E. BURTON.

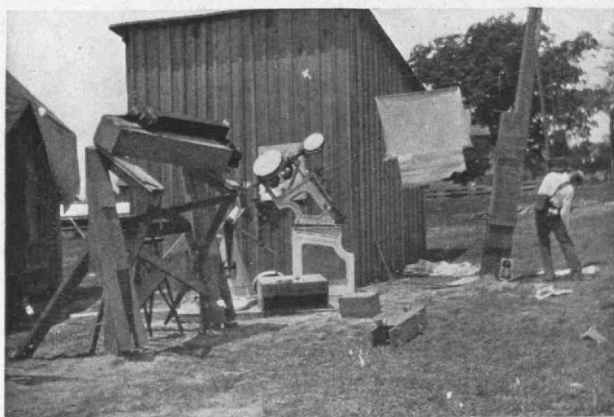
JULY 1, 1900.



Volunteer Observers.

## INSTITUTE MEN AT WADESBORO, N.C.

Although the Institute eclipse party proper was in charge of Professor Burton at Washington, Ga., the Institute was also very prominently represented at what was probably the largest station along the line of totality, Wadesboro, N.C. Here Professor Hale, Course VIII, 1890, was in



Professor Hale's Bolometer-house, Spectrascopes, and Siderostat.

charge of a large party from the Yerkes Observatory, and Mr. Charles G. Abbot, Course VIII, 1894, was in charge of the Smithsonian party organized by Professor Langley. The Yerkes party was also assisted by Professors Noyes, Laws, and Goodwin, of the Institute; and Mr. Abbot was assisted by Mr. Frederick E. Fowle, Jr., Course VIII, 1894, a member of the regular staff of the Astro-Physical Observatory of the Smithsonian Institution. When it is also remembered that the Harvard Observatory party included Professor J. R. Edmands, 1869, with Professor

William H. Pickering, Course VIII, 1879, in charge, and the Blue Hill Observatory party was in charge of Mr. A. Lawrence Rotch, 1884, it is certainly astonishing to find so many Institute graduates now prominent in astronomy. That the training given in our college should prove so successful a foundation for a career in the purest of all the sciences, speaks volumes for the breadth and scientific foundation of that training.

Besides the Yerkes and Smithsonian parties at Wadesboro were Professor Young's party from Princeton, and the Rev. Dr. Bacon's party from London, the only European expedition which visited this country. There were, besides, numerous private observers. Professor Young stated that never before had such valuable apparatus been collected and such elaborate preparations been made at any one place for observing an eclipse as at Wadesboro. The work planned by the various observers was very comprehensive. Professor Hale and Mr. Abbot attacked independently the previously unsolved problem of the heat radiation of the corona with the aid of the bolometer; a small but undoubted radiation, somewhat greater than that from the moon was detected. Professor Barnard, of the Yerkes Observatory, and also several members of the Smithsonian party, undertook the photography of the corona on an unprecedented scale. Professors Young, Hale, and Frost made an elaborate study of the spectra of the "flash" and of the corona. A search was also again made for an intra-mercurial planet by the Smithsonian people; and observations were made on the shadow bands and meteorological phenomena by Mr. Clayton, of the Blue Hill Observatory.

The conditions for observing the eclipse were absolutely perfect. The corona was of unusual beauty and brilliancy, as had been anticipated, it being now a minimum sun-spot



Professor Barnard's Great Camera for Photographing the Corona.



Smithsonian Camera for Photographing the Corona.



period. On the other hand, the "corona line" in the spectrum of the corona was so exceedingly faint that it was seen by only one observer at Wadesboro. Whether it was successfully photographed by any one remains to be seen. The scientific value of the many photographs taken can be determined only after they have been developed and reduced; but important results are anticipated. All who went down from the Institute voted the trip a grand success.

H. M. GOODWIN, '90.

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## COMMENCEMENT WEEK

The first of the events of Commencement Week was the cordial reception extended to the graduating class by the Alumni Association. This was, as usual, held at the Exchange Club on the evening of the Friday preceding Commencement Day. About one hundred alumni and one hundred and seventy-five of the class were present.

The half-hour before eight o'clock was occupied in giving and receiving congratulations and in meeting those present in the reception-rooms. At eight o'clock Mr. Leonard, the president of the class, announced that the guests were invited to the spread. After the spread all assembled to listen to the speakers of the evening.

President Miller of the Alumni Association, after a few brief remarks, introduced President Crafts, who was greeted with most hearty applause. President Crafts said:—

*Mr. President of the Alumni:*

I am glad that in your remarks you alluded to my position in the way that you did, and did not speak of it as en-



tirely one of separation, because I cannot feel that, in taking a small laboratory room and beginning over again the chemical researches which have occupied the greater part of my life, still finding myself working here in the midst of you, I am separating myself from the school or its interests; it is only from its administrative work; and I hope that the opportunities will be many for seeing all those with whom my position has enabled me to have a closer and very friendly intercourse.

To the class of 1900 I would say that our terms of active work in the school have nearly coincided. When you entered in 1896, you had every reason to expect a long administration and a prosperous one, and that General Walker would have the satisfaction of handing you your degrees at the end of your course. On the 5th of January, 1897, everything was changed by the blow which caused a sad and irreparable loss to the school. Some seventeen years before, when the President was chosen, the government of the school selected a man who was young at that time, considering the reputation he had already made,—not much more than forty years old. He was known as an earnest and enthusiastic teacher; a man of strong, genial, and sympathetic temperament; a lover of men, and particularly of young men; a gallant and successful soldier, using while very young his opportunities as a staff officer in the Army of the Potomac to show high executive ability, doing with all his might whatever he had to do. Here was a man of great promise and of great performance; but still there might have been reason to hesitate in making a choice for the head of this professional school, for his university experience had been in teaching Latin and Political Economy, and in this science he had seemed to dwell with special interest upon the element of wilfulness in man's dealing with man. As you know, extreme precision and mathematical methods form the backbone of our school system. Well, it is needless to tell you how General Walker fulfilled his task; but perhaps you do not realize how much it was a field where he had to be a learner before he became

a teacher. I am told that during the first year he was an observer,— he had relatively little to say about how things should be done. Then ever more and more he took the measure of men and things, and became the real head of the whole body. You, as a Freshman Class, did not come much in contact with the President; but you must have heard accounts of his genial intercourse with all the classes, and you will remember the shock that his death caused and the testimonials of affection from all sides.

It is not necessary for me to say anything about the details of my own administration. I found a house in order, and have endeavored to keep it in order. One circumstance gives me regret and great satisfaction. It so happened that my term in office coincided with great accessions to the funds of the Institute, so that between 1896 and 1899 the reports show that the income-bearing funds increased two and a half times. I regret that this money did not come in time to relieve the care and anxiety which always weighed upon General Walker, while carrying out with sublime faith his bold policy of continual expansion. His life might have been spared longer if he had been relieved from anxieties about ways and means. I have had great satisfaction in finding the means in my hands for building at last laboratories, drawing and modeling rooms, which are in many respects the best in the world, which are suitable to the courses of instruction, which are also in many respects a model to the rest of the world.

I hope that a new building for the Physical Department can soon be erected under like favorable conditions. You know that more land has been purchased, which will eventually be covered with buildings to accommodate some two thousand students. If we are crowded with that number, the places could be reserved more and more for regular students, so that classes of two hundred and fifty or three hundred, could be graduated; and that is quite sufficient for one professional school of this character. Some years will doubtless elapse before the land will be covered

with buildings, and during that time the unoccupied ground can easily be laid out as a playground; and it will be more convenient than was the sunken land once used for that purpose, and now occupied by the Walker Building.

By a somewhat unexpected turn of events there are present to address you to-night both the outgoing and the incoming Presidents. I fancy they may each be thinking from different points of view of two lines of poetry,—views taken through opposite ends of the telescope; and you will say that it is probably the astronomer who is looking through the right end. The lines were written by a professor who was more richly endowed with the poetic faculty than are most professors, although that did not hinder him from being a very good lecturer upon anatomy. I have in mind Dr. Oliver Wendell Holmes. The lines are:—

“Uneasy lies the head that’s born to rule,  
And most of all whose kingdom is a school.”

And now I have a pleasant task to perform,—that of introducing to you the President-elect. It might seem superfluous, since your studies have ceased. He will not have the task of overseeing your work, nor the privilege of handing you your well-earned diplomas,—a privilege which I value highly,—but will be, I hope, the head of this school through many long years. And no one of you feels that your connection with the Institute ceases when you graduate. If the school has done anything for you, it has done it through the generous aid and support of its friends, and it is now counting ever more upon the support of its alumni; and an excellent support is the evidence of the close and friendly relations which induce you to come back and visit us, to join Tech associations, and to write to us about your careers. I have no doubt the new President will find these consultations with you among the pleasant things in his new duties. We value the free intercourse with alumni who know and love the school, and have often new things to say about it, as they climb ever higher the steep hill of success, and look back upon a broadening landscape.

The new President is not an old man. He seems young to me, and he is a very young man to be called to this place. He is of about the same age as General Walker when he came here. He has the great advantage of being able to outlive some of the things which he does not like, and to live long with the men and the schemes of work which he shall choose and initiate. He comes equipped with the exact knowledge of the mathematician, with the experience of a teacher of engineering, and with the administrative capacities which come from playing the part of a man among men at the head of a great governmental department. He comes to find no quarrel to settle, no disorders to remedy, but to receive a hearty welcome and to feel sure of the good will of all. He comes into the acquaintance and good fellowship of the alumni, and that will not be the least of his advantages.

I have the pleasure to present to you Dr. Henry S. Pritchett, President-elect of the Massachusetts Institute of Technology.

President-elect Pritchett received a most cordial welcome. Dr. Pritchett's address was in part as follows:—

I am here to-night, not in an official capacity, but as the latest member of the class of 1900; and as such it is fitting to be modest, and say nothing. But I want to say a few words to you. I come from one of the great engineering bureaus of the country, one of the oldest of government enterprises. There are carried on operations of the highest moment, and the work is so very interesting that a man would not leave unless great attractions were offered him.

Any one knowing the Massachusetts Institute of Technology knows that it holds up the highest standard of technical education, for here it is necessary to learn one thing well. If there was ever any time when that was needed to be done, it is now. Wisely or unwisely, we have come into possessions beyond the ocean where the building of railroads and canals and the development of the country will require the best efforts of American engineers.

Dr. Pritchett then paid a tribute to President Crafts, and continued :—

I desire to be more to you alumni than merely President of the Institute. I desire to enter into personal relations with you. Accept me as a personal friend, and give to me your personal help and advice. And I hope that, as we come to know each other, you will welcome me not only because of your regard for Technology, but for your friendship for myself.

Following Dr. Pritchett, President Miller introduced Professor Robert H. Richards, who spoke of the development during the past years and of the all-important need of alumni interest for the future growth of the Institute. The school would be what the alumni made it. President Miller then presented Dr. Mixter of the class of '75, who alluded somewhat humorously to his Institute days and the old-time Commencement. The last speaker was Mr. C. M. Leonard, president of the class, who thanked the alumni for their most cordial welcome. The Glee Club gave several selections during the evening. For Dr. Pritchett's address, as well as the following addresses, thanks are due to the courtesy of the TECH.

Upon Saturday evening, the 2d, the Glee, Banjo, and Mandolin Clubs tendered a concert to the graduating class and friends. Although a number of the members of the clubs were unable to be present, the concert was most successful. Huntington Hall was crowded, and the audience was a most appreciative one.

The class met in Trinity Church upon Sunday for the Baccalaureate Sermon, which was delivered by the Rev. George Hodges, of Cambridge. Although the day was far

from pleasant, the church was crowded with the friends of the graduating class. The following is the Baccalaureate Sermon : —

“And the Lord added to the church daily such as should be saved.”—  
ACTS II. 47.

They stood where you stand, at the beginning. They had in their hearts the same strong desire which you have : they wanted to succeed.

It is true that they expressed it differently : they stated it in the phrase of the church rather than in the phrase of the street. What we call success they called salvation. “What shall we do,” they said, “to be saved?” But the difference is chiefly in the words. They had in their minds what you have in your minds to-day. For to be saved is to succeed supremely.

It is true that success commonly suggests something secular. We call a man successful who gets on in his business, who makes money or a name. And salvation, in common speech, suggests something spiritual : the saved man is he who is sure of going to heaven when he dies. But neither of these definitions is sufficient. *Salvation*, properly understood, is spiritual soundness. It means sanity and strength ; it is the good health of the whole man. And it has to do with this present life. We are saved when we are delivered from our sins, and are strong in conflict with temptation, and are open and receptive to all high influences, and live the life which befits a son of God. To be saved is not to be admitted through a gate into a garden, and thenceforth to look out between the palings at the dusty road. The essential thing is not where we are, but what we are. The heart of salvation is not a better place, but a better man. And that, you see, is the definition of all good *success*. That is what you want. In the new life for which you have been preparing and into which you are now entering, you will not be content to be chemists or electricians or engineers or captains of industry : these are excellent callings, but they will not satisfy you. No ! the supreme ambition which you have



is to be a man,— to be a sturdy, straightforward, erect, clear-eyed, right-minded man. To be less than this is to fail. It is to belong to the defective classes. Blind Tom, for example, was an extraordinary musician; but he was not a man, in any true sense. He was an idiot. In the same way, one may be a capital workman, scholar, architect, administrator, and yet not be a man. He may be defective in mind or in morals. He may be a machine or an animal. The essential quality of manhood is character. And to attain character is at the same time to succeed and to be saved. Here the two meet. Without character there can be neither salvation nor success.

Success, then, is not so much a commercial as a spiritual matter. It depends not on what we get, but on what we are. It is founded on character. And, because character is so profoundly affected by religion, success and religion are vitally related. Thus it is that you mark this great transition out of the life of apprenticeship into the life of responsibility by a religious service: you ask for counsel at the lips of a minister of religion.

Let us remember what was said upon a like occasion, when the apostles were the spiritual advisers. It was on the Feast of Pentecost, whose anniversary is being kept to-day in the church. Men were stirred with a strong sense of discontent with themselves, and were pressing forward into a new and different way of living. The past they had thrust behind them; their faces are set, as yours are, towards the future. "What shall we do to be saved?" What shall we do, that we may live aright, that we may the better draw near to the ideal, that we may the more effectively serve our fellow-men and please God? What shall we do to succeed? What shall we do, that we may in the fullest sense make the most of ourselves?

What did they do? We read that the apostles told them to ally themselves with the Christian society, and that, accordingly, they were added to the church. The Lord added to the church daily such as desired to be saved. The men were taught that, if they wished to suc-

ceed, if they wished to grow in strength of character and in the spirit of service, they must be socially-minded, they must take their place in the new fraternity of the brethren of the ideal life.

This is the Whit-Sunday lesson which I would bring out of that old time into this present. Let me state it with all frankness. There are many things which we desire of you, but the one of which I purpose to speak is this: we want you men, for your own sake and for the general good, to come to church. You will go back in a few days to your several homes in various parishes. You are to be men of leading in your community. The minister will wait to see in what direction you will lead, whether you will help him or not. He may not say anything to you: the minister is somewhat reluctant to ask a man to come to his church,—more reluctant perhaps than he ought to be. He may not ask you; but he will look at you as the Master looked at the rich young ruler in the gospel, with affection and with expectation. He wants you more than you can know. He notices your presence and your absence. The church may be full—of women: thank God for their devotion, for their helpful enthusiasm, for their splendid maintenance of all good causes. But the minister will miss you if you are not there. He will account all his other success as of no value if he does not succeed in winning and keeping you. Let me say that for him, since he is not likely to say it for himself. It makes a difference, such as I am sure you do not realize, whether or not you are in church.

Consider it in these two aspects: first, as it concerns the best interests of the individual; and, secondly, as it concerns the service which he should render to the community.

It is characteristic of human nature that it needs times and seasons and appointed places. That which is best in us often waits for suggestions from without. So that he who says, I can shape my character outside the church as well as in, I can minister by myself in my own way to



my own life, is altogether likely, after the first enthusiasm, to find himself neglecting that which he honestly intended to perform. Solitude, whether social or spiritual, is excellent for an hour or a day; but it is not the natural state of human beings. All experience shows that we need society. Thoreau spent but a year in his seclusion at Walden Pond. The hermits stayed longer, and fared worse. It is hard enough, under the best conditions, to live the life which is appropriate to a member of the family of God. He who tries to live apart from the rest of the family adds to the difficulties, of which there are enough already. While he who resolutely, week by week, keeps in vital relation with the religious institution, and hears the word of exhortation and instruction, and takes upon his lips the sentence of prayer and praise, is thereby helped and strengthened. He sees ideals clearer, and meets temptations better, and thinks higher thoughts. Is there any doubt about it? Is it not good philosophy? Is it not in accord with universal human nature?

The question, then, is how to be of service to the neighbor. And the answer is that every man may be of service in two ways,—by his good example and by his alliance with the great beneficial forces. For both these kinds of service there is an especial opportunity every Sunday morning.

For he who identifies himself with the Christian Church sets a good example. That is plain enough. He himself may be in much or little need of what the church can give him; but somebody else, who is affected by his example, needs the church, and needs it imperatively. Somebody there is whose destiny may depend upon what he gets at church next Sunday. There he may hear a word in service or in sermon, or in the silence of his own soul, which will make an everlasting difference with him. As he turns the corner to the church, he will change the whole direction of his life. But he waits for you. He waits to see what turn you make; and, when you pass by without going in, he follows in your steps.

You say to him as plain as words, "The church is not worth while"; and he is obedient to that advice. Every citizen who stays at home on Sunday, forsaking the institution to live his individual life, hangs out a flag at his front door, inscribed, "The church is not worth while." And, the wider his influence in the community, the bigger the letters in which that legend is set forth. Every Sunday every man in the neighborhood has a definite opportunity to serve his fellow-men by his good example.

Here is the Christian Church with all its manifold shortcomings, with its weaknesses and sins, with its grievous divisions and contentions, with its neglected opportunities, — what other agency even remotely approaches it in its social possibilities or in its spiritual results? Here may the man of affairs consecrate his executive strength to the best service of his fellow-man, to the marshalling of the hosts of God against the armies of the devil. Here may the scholar bring his wisdom and his devout pursuit of truth into relation with the daily needs of men. Here may the young man bring his manhood, bring his courage and his hope, bring his high enthusiasm, and devote it to the holiest of missions, beginning the week as the knight began his quest, with his sword and shield laid down before the altar.

We must confess, indeed, that the church is not everywhere a young man's church. You may not feel at home in it. You may find that it is conservative when you desire to be progressive. Going out into your new life with large ideas, the church may seem to you to be occupied with petty interests. Concerned as you are in the whole range of human life, upon which you have looked from the academic heights, the church may seem remote and isolated, and out of relation to the common day. Compel it, then. Take it by storm. Do your best to make it what it ought to be.

Gentlemen of the class of 1900, we cannot realize these ideals without you. They are worth realizing: that is plain. To make them effective in any community is to render a

high service to humanity. A church into which men go to worship God, and out of which they come to serve their fellow-men, is the best blessing that any neighborhood can have. Whether there shall be such a church in your neighborhood depends in large measure upon you. You desire to succeed. You look out to-day into the future, praying for that, planning for that. And success means the culture of your character and the best use of your power. You need the church even more than the church needs you. For your sake, for your brethren's sake, you need to be added to the church.

Monday, the 4th of June, was Class Day, the exercises being held, as usual, in Huntington Hall, at half-past two. The hall was very tastefully decorated with palms and festoons of evergreen. Upon the platform were the Class Day officers and the committee, the officers being the following: First Marshal, Percy Rolfe Ziegler; Second Marshal, Walter Louis Rapp; Third Marshal, Marcy Leavenworth Sperry; President of 1900, Clifford Milton Leonard; Historian, Herbert Milton MacMaster; Statistician, Newitt Jackson Neall; Prophet, Frederick Hosmer Cooke; Poet, Herbert Holmes Howe; Orator, Charles Van Merrick. The full report of the addresses is given in the Commencement number of the *TECH*.

After the conclusion of the exercises the First Marshal cordially invited all to the spread served on the lawn between the Rogers and Walker Buildings. This formed a most pleasing innovation, in former years the spread having been held indoors. Entirely surrounding the lawn was placed a dense row of evergreen trees, which effectually enclosed the space and gave a pleasant effect to the scene. Chairs were provided, and the refreshments were at the side facing Newbury Street. A stringed orchestra played dur-

ing the spread as also during the intermissions in Huntington Hall.

The Commencement exercises occurred on the afternoon of Tuesday, the 5th, degrees being then granted to one hundred and seventy-eight members of the class. Huntington Hall was filled to overflowing, and many were unable to find seats. The class filed in as a body, the centre of the hall being reserved for them, and arose when the Faculty and Corporation appeared upon the platform. After a brief introduction by President Crafts, short abstracts of the following theses were read:—

COURSE I.—Clinton Draper Thurber. "Experiments to determine the accuracy that may be attained with the Pitot tube in the measurement of the flow of water through pipes."

COURSE II.—Arthur Clarence Walworth, Jr. "An investigation of the friction of steam in elbows and bends."

COURSE III.—Stephen Badlam. "An investigation of the effect of annealing upon the physical properties and micro-structure of a low-carbon steel."

COURSE IV.—George Burdett Ford. "Design for a university library."

COURSE V.—Harry Martin Thayer. "The recovery of zinc from pyrite residues."

COURSE VI.—Leigh Shelton Keith. "A study of the wave forms in the three-wire generators of the Institute plant at Trinity Place."

COURSE VII.—Harold Sargent Conant. "A study in variation, taking certain features of the shell of the marine gastropod, *Purpura lapillus*."

COURSE VIII.—Grace Langford. "An investigation of the effect of dilution on the color of copper solution, and its relation to the dissociation theory."

COURSE IX.—Joseph Porter Draper. "A review of State legislation since 1890 in regard to trusts."

COURSE X.—Stanley Gay Hyde Fitch. "The mercerization of cotton, with the addition of aluminates, silicates, glycerine, and glucosides to the mercerization bath."

COURSE XI.—Charles Mussey Fosdick. "A plan for the disposal of the sewage of Fitchburg, Mass."

COURSE XII.—Robert Coffin Simpson. "Collection and reduction of data for the powering of ships."

President Crafts then addressed the class :—

*The Class of 1900*,—You have passed with us four years of faithful work, as your degrees testify,—four years of companionship with each other, as some society badges, some offices in class organizations, some remembrances of victories or defeats in team athletics, and, what is far better, many close friendships testify.

The sum of all these is a certain quantum of solid acquirements, which you are going to use as tools with which to do your life's work, and a certain *esprit de corps*, which you perhaps to-day call class feeling, but which, as you join an association of graduates in the East or West, will merge into a Tech feeling. To-day you belong to 1900,—a momentous date. We have nearly finished the century together, and we may consider it an appropriate moment to make up our accounts; and I think our few last moments together cannot be better spent than in considering how far the education you have received here will fit you for the far more important business of educating yourselves through the rest of your lives. I do not mean that you will henceforth do your work alone. You will have plenty of educators in the things and people surrounding you; but it is a slowly acquired and difficult art to learn from things, and one which has only been successfully practised of late years,—chiefly by men of science; while people, even if they have the will, do not often know the way to teach you. They will be chiefly guided by their own interests, not yours; and their lessons will not always be given in the same kindly spirit which, I think, you will be

ready to say is characteristic of the teachers in this great professional school.

Some men will say that many practical things cannot be taught; but I believe that, with a good method, almost anything can be taught. It will be objected that Plato did not teach his scholars to think and write like himself, that Goethe left no school. Yet I would like to see an attempt made by a great thinker or writer to do what is done everywhere by great artists, who teach that most unexplainable thing,—artistic conception. We believe and we practise here on the belief that the art of composition in architecture can be taught; and the world is full of examples of great masters who have had great scholars, when they possessed the rare gift of teaching. I prefer, however, in this brief talk, not to enter upon the consideration of any new field of untried and difficult experiment, but to pass your own work in review. You have mostly chosen occupations where the methods of teaching, although of recent date, are perfectly sure and successful. The old philosophy decreed that speculations regarding man's nature and destiny were the only subjects worthy of attention, but it made so little progress with the methods that we are not much farther advanced than in the days of Socrates. Modern science assumes that it is man's chief business to know everything that can be known, but cares little for knowledge that is not sure. In the quest for the exact and absolute truth she has invented methods of discovery and of control which have changed the whole aspect of human thought, and in her scheme a place is found for every skilful and conscientious worker. Text-books have multiplied till they show just what has been done and just what is wanted for the next step forward. Like the design of some great engineer, the scientific programme is put into the hands of thousands of workers for execution. Each one is assigned a place according to his talents, and an appointed task, to do the thing known or to seek the unknown. In this latter sphere the highest imagination and the most poetic fancy may find scope. You have learned



that the discovery of a natural law is a work of imagination, but a trained imagination, using sure methods and abhorring guess-work. Our lay brethren suppose that we believe nothing until we have completed every possible proof. That is not our method. We use modes of reasoning quite unfamiliar to them, but which we have found to be excellent guides toward the truth. We collect facts, and then we propound a theory which tells how to find and arrange new facts which may support it or may kill it. We are not foolish enough to stop living and acting until the laws we live by are absolutely proved. We use our caution, our skill and experience, to select the surest and most rational assemblage of facts that we can find at a given time, we test them by certain signs known to us, in order to see if they are really coherent; and in such a task empiricism and unskilled labor are worse than useless, but imagination is essential. Then, when all is done as well as it can be done for the moment, we accept the law as a rule of conduct until we can get a better. Truly, faith is the evidence of things unseen.

It has been our duty and our practice to be quite open with you, and to tell what we are sure we know and to confess that many things are beyond our knowledge. Each one of you, according to your several tastes and abilities, has learned to do some one thing well, and intends to go out from here and practise his art; but, what is of more value to you, you have been introduced, if only on the threshold, to new regions of scientific thought by men who have been your teachers and companions, who have gone farther than yourselves, but have made no mystery about their methods, and have taught you at least some of the basic principles by which, for the first time in the history of the world, continuous and unchecked progress has been made.

If I have been successful in describing some of the leading features of the education which you have received here, let me say a word regarding their bearing upon the much longer and more important task which

will fill the years before you. All our records of graduates show that you are likely to remain more faithful to your training than the graduates of any other kind of professional school, be it law, medicine, or divinity. More than nine-tenths of you will do some scientific work. You, perhaps, could not come back here at any given time and pass over again any of the test examinations which the diplomas handed to you to-day testify that you have passed successfully. You will have forgotten most of the dry facts which you have taken in or crammed, but what will remain will be habits and methods of work and general principles. Some men of genius teach these to themselves or seem to get on without them; but you have done well to come to a school to learn them, for the world, in general, made very little progress until they were taught, and well taught, in schools. The day when Liebig opened his laboratory at Giessen, and taught students how to make original researches, marked a new era in the history of thought. The art of assembling things together and making them do the right thing for you, in order to solve some given problem, is a most fascinating art. He who has once mastered it, and learned to love it, will have a happy occupation for the rest of his life.

If I have explained rightly these scientific methods, you will agree that they also nurture the highest qualities of faith and imagination, and subject them to tests more immediate and sure than any other kind of training.

These claims for science are not empty words, as you will find when you join the great army of experts, some twenty to thirty thousand strong, in this country, the integrity of whose lives is shown by the integrity of their works; and none have done more than the graduates of the Massachusetts Institute of Technology to maintain a high standard of professional honor in this country.

And now, in conclusion, let me speak for your teachers, and say that you are a satisfactory set of men to teach. You made up your minds before you came here what you



wanted to do, and did it earnestly. You have been willing to take the work we gave you, and have sometimes asked for more. You have recognized that we have your interests at heart, and that our purpose was the same as yours; namely, to do all we could, and do it in the right way. Most of you have come from homes where you have been taught to believe that the earnest responsibilities of life begin at the age of eighteen or earlier, and not at twenty-two or later. It is not a bad thing to be born into circumstances that give you the advantage of good training, but which do not permit idleness. The knowledge which is now your capital in business is a safe security. Opulence is not always hereditary in this country, and the Daughter of Fortune is too often named Misfortune; and so you are going away from us to scatter north and south, east and west in our great country, or perhaps South Africa and the Eastern Islands, and you bear with you a reputation to sustain, that of the best type of American citizens and of the most honorable of our professions.

You know that you do not get away from our examinations when you leave this place, and that there is a book of record in our archives which, I hope, you will help us to keep well filled with the events of your lives. And I may say that there is no feature so satisfactory in our school work as turning to that book, and finding evidences there that you have built up some substantial structure upon the basis of education which was solidly laid down here. Come back to us, then, as often as you can individually or by reports of your alumni meetings. Keep this school in your remembrance, and help in after years to do for others any good thing which you feel it may have done for you.

The diplomas were then given to the candidates, and the exercises were closed.

Following the exercises, President Crafts held a reception in the new library, Mrs. William B. Rogers and President-elect Pritchett assisting him in greeting the graduating class and their friends.

In the evening President-elect Pritchett was tendered a reception by the Technology Club at its house on Newbury Street, an account of which will be found on another page.

### CANDIDATES AWARDED DEGREES IN THE SEVERAL DEPARTMENTS, WITH TITLES OF THEIR GRADUATION THESES

I. Civil and Topographical Engineering; II. Mechanical Engineering; III. Mining Engineering; IV. Architecture; V. Chemistry; VI. Electrical Engineering; VII. Biology; VIII. Physics; IX. General Studies; X. Chemical Engineering; XI. Sanitary Engineering; XII. Geology; XIII. Naval Architecture.

DAVID GUSTAVUS ABEEL (I.), *Catskill, N.Y.* A Design for a Ferris Wheel.

GEORGE ORLANDO ADAMS (V.), *North Andover.* Tests on the Corrosion of Iron.

ELBERT GROVER ALLEN (II.), *Brockton.* A Road Test of a Ten-wheel Two-cylinder Compound Passenger Locomotive. (With P. R. BROOKS.)

HARRISON EVERETT ASHLEY (X.), *New Bedford.* A Study of Alloys of Antimony and Tellurium.

STEPHEN BADLAM (III.), *Dorchester.* An investigation of the Effect of Annealing upon the Physical Properties and Micro-structure of a Low-Carbon Steel.

REUBEN WILFRED BALCOM (V.), *Framingham.* An Attempt to Prepare an  $\epsilon$ -Oxyacid or its Lactone.

CHARLES EDWARD BALDWIN, A.B. (V.), *Cambridge.* Some Properties of Cellulose Tetracetate.

JAMES EDMUND BARKER (VI.), *Pasadena, Cal.* An Efficiency Test of the Trinity Place Lighting Plant of the Institute. (With R. S. BLAIR.)

MORGAN BARNEY (XIII.), *New Bedford.* Progressive Speed Trials of Steam Yacht "Freelance."

CHARLES AUGUSTUS BARTON, Jr. (VI.), *Ravenswood, Ill.* Measurement of Energy in Polyphase Circuits. (With J. B. CONANT.)

JAMES HERVEY BATCHELLER (III.), *Charlestown.* The Electrolytic

- Precipitation of Gold from Cyanide Solutions by the Siemens-Halske Process. (With G. M. HOLBROOK.)
- JOHN VAN DERVEER BEEKMAN, Jr. (IV.), *Plainfield, N.J.* The Structural Design for a Municipal Market and Exchange.
- ROBERT SHERMAN BLAIR (VI.), *Waterbury, Conn.* An Efficiency Test of the Trinity Place Lighting Plant of the Institute. (With J. E. BARKER.)
- INGERSOLL BOWDITCH, A.B. (I.), *Jamaica Plain.* A Project for the Development of the Storage of Beaver Pond Basin, at the Head Waters of the Charles River. (With G. C. GIBBS.)
- ALBERT BILLINGS BRIGGS (I.), *Wollaston.* A Design for a Coal-handling Plant for a Railroad.
- CHARLES CALVIN BRIGGS, Jr. (XIII.), *Pittsburgh, Pa.* A Design for an Ocean Tugboat.
- HENRY MATTHIAS BROCK, A.B. (VIII.), *Roxbury.* An Investigation of the Electrical Conductivity of Fused Salts. (With A. S. PECK.)
- MILES ELIJAH BROOKS (I.), *Boston.* A Plan for the Abolition of Grade Crossings on the Boston & Maine Railroad at Everett, Mass. (With W. C. TUDBURY.)
- PAUL RAYMOND BROOKS (II.), *Chicago, Ill.* A Road Test of a Ten-wheel Two-cylinder Compound Passenger Locomotive. (With E. G. ALLEN.)
- CHARLES HOYT BROWN (X.), *Wellsville, N.Y.* The Sizing of Cotton Yarns. (With H. T. SHAPLEY.)
- CLARENCE CLAPP BROWN (VI.), *Reading.* Wave Forms of Current and Electromotive Force of Phasing Transformer. (With R. M. HOPKINS.)
- JOHN WESLEY BROWN (V.), *Newburyport.* The Formation of Formic Aldehyde as a Product of the Partial Oxidation of Ethyl Alcohol and Acetone.
- STEPHEN PEARSON BROWN (II.), *Dover, Me.* The Relative Efficiency of Bearings and Lubricants of a Spinning Frame under Mill Conditions. (With G. O. SCHNELLER.)
- FREDERICK DELANO BUFFUM (II.), *Winchester, N.H.* An Investigation of an Axial Oil Machine.

- EDWARD EVERETT BUGBEE (III.), *Brookline*. The Refining of Crude Copper. (With D. S. JOHNSON.)
- ROY GIBSON BURNHAM (II.), *Essex*. Some Experiments on a Shaft Governor. (With T. D. PERRY.)
- KARL BURROUGHS (X.), *Somerville*. The Effects of the Absorption of Gases on Sterling Silver.
- MARION LOUISE CADE (V.), *Cambridgeport*. The Action of Dehydrating Agents on Ammonium Salts of Organic Acids.
- JOHN CAMPBELL (III.), *Pittsburg, Pa.* Methods of Extracting Lead from By-products Obtained in the Manufacture of Lead Oxides.
- LLEWELLYN LEOPOLD CAYVAN (V.), *South Boston*. The Estimation of Phosphates in Potable Waters.
- WALTER CRANE CHAFFEE (IV.), *Detroit, Mich.* A Structural Design for a Modern Steel Office Building.
- WALTER NATHAN CHARLES (I.), *Roxbury*. An Investigation of Modern Grain Elevators, with a Design.
- AURIN MOODY CHASE, B.S. (II.), *Syracuse, N.Y.* The Effects of Different Methods of Hardening High-Carbon Steels. (With W. A. EDSON.)
- ROBERT HODGEN CLARY (III.), *Seattle, Wash.* A Study of Fine Concentration. (With G. A. TWEEDY.)
- RUDOLPH JULIUS CLAUSEN (IV.), *Davenport, Ia.* A Design for a Public Library for a City of 40,000 Inhabitants.
- PERCIVAL CHARLES CLOW (IV.), *Orange*. A Structural Design for a Modern Steel Fire-proof Building.
- WILLIAM RAWSON COLLIER (VI.), *Atlanta, Ga.* A Study of an Electrically Propelled Vehicle. (With L. W. SHUMAKER.)
- FRANKLIN NORTON CONANT (VI.), *Boston*. A Direct Determination of Individual Wave Forms in a 10,000-volt Circuit. (With W. C. DEAN.)
- HAROLD SARGENT CONANT (VII.), *Gloucester*. A Study of Variation in the Shell of the Marine Gastropod, *Purpura lapillus L.*
- JOHN BANCROFT CONANT (VI.), *Boston*. Measurement of Energy in Polyphase Circuits. (With C. A. BARTON, Jr.)

- FREDERICK HOSMER COOKE (I.), *Cincinnati, Ohio*. A Design of a Two-hinged Steel Arch with Riveted Connections.
- EDWARD HATTON DAVIS (IX.), *Hyde Park*. The New York Bank Statement and an Inquiry into its Function as an Index to the Financial Condition of the Country.
- WALTER CLARK DEAN (VI.), *Dalton, Pa.* A Direct Determination of Individual Wave Forms in a 10,000-volt Circuit. (With F. N. CONANT.)
- PAUL HOLMES DELANO (I.), *Kingston*. A Design for a Masonry Dry Dock.
- WILLIAM ASBURY DOREY (III.), *Cincinnati, Ohio*. Decomposition of Zinc Sulphate by Heat. (With R. P. ROBERTS.)
- JOSEPH PORTER DRAPER (IX.), *Canton*. A Review of State Legislation since 1890 in regard to Trusts.
- FRANCIS BIRD DUTTON, A.B. (X.), *Auburndale*. A Process for Making Paper Stock from Flax.
- WARREN ADAMS EDSON (II.), *Dorchester*. The Effects of Different Methods of Hardening High-carbon Steels. (With A. M. CHASE.)
- SAMUEL BASS ELBERT (III.), *Des Moines, Ia.* Concentration of Copper Ore from Cape Breton.
- CARLETON ELLIS (V.), *Keene, N.H.* A Study of Gold Chloride in Solution.
- LEWIS EMERY, 3d (III.), *Bradford, Pa.* The Milling of a Nova Scotia Gold Ore, with Special Reference to Concentration. (With W. L. STEVENS.)
- ETHEL FRANCES FIFIELD, A.B. (IV.), *Salem*. A Design for a College Settlement.
- STANLEY GAY HYDE FITCH (X.), *Dorchester*. The Mercerization of Cotton without Tension.
- GEORGE BURDETT FORD, A.B. (IV.), *Clinton*. A Design for a Library for a Large University.
- CHARLES MUSSEY FOSDICK (XI.), *Fitchburg*. A Plan for the Disposal of the Sewage of Fitchburg, Mass.
- GERALD FRINK (II.), *Seattle, Wash.* A Partial Design of a Logging Locomotive.

- WILLIAM HOWARD FULTON (VI.), *Chelmsford*. A Photographic Method of Recording Wave Forms in a 2,000-volt Circuit. (With H. L. MORGAN.)
- EDWARD GERALD GALLAGHER (VI.), *South Framingham*. Harmonic Analysis of Alternating Current Wave Form. (With M. C. MOTT-SMITH.)
- STEPHEN FRANKLIN GARDNER (II.), *Somerville*. A Design of a Central Heating Plant.
- CARL FRIEDRICH GAUSS (IX.), *Colorado Springs, Col.* The English, Russian, French, and German Governments in Relation to the Developing of their own Trade in China.
- GEORGE CROCKER GIBBS, 3d (I.), *New Bedford*. A Project for the Development of the Storage of Beaver Pond Basin, at the Head Waters of the Charles River. (With INGERSOLL BOWDITCH.)
- JOHN THOMAS FISKE GLADDING (II.), *Providence, R.I.* The Design of an Oil Machine.
- FREDERIC STANLEY GOODRIDGE (II.), *Lynn*. Some Experiments on a Pendulum Governor.
- LOUIS NELSON GOWELL (IV.), *Weston*. A Structural Design of a Railway Terminus.
- MILTON WESTON HALL (VII.), *Evanston, Ill.* An Investigation of the Behavior of the Bacillus of Typhoid Fever in Milk.
- STEPHEN MINARD HALL (VI.), *Waverly, N.Y.* Relation of Temperature to Voltage, Capacity, and Efficiency of Storage Batteries.
- CYRUS HOWARD HAPGOOD (VI.), *Everett*. An Investigation of Resonance in Alternating Current Circuits. (With T. E. PENARD.)
- HARRY MACY HARPS (I.), *Nantucket*. Experiments on the Flow of Water through a Standard Mouthpiece. (With LEWEN F. SEARLE.)
- GARABED G. HEGHINIAN, A.B. (XI.), *Marash, Turkey*. A Study of a Septic System of Sewage Purification and its Application at Brentwood, N.H.
- DEAN HINMAN (I.), *Taunton*. An Investigation of the Design and Construction of Standpipes.

- TOMOKICHI HIROKAWA, B.S. (VI.), *Imabari, Japan*. The Carrying Capacity of Aluminium Wires.
- CHARLES WENTWORTH HODSDON (II.), *Cambridgeport*. A Study of Wind Pressure.
- GEORGE MYRON HOLBROOK (V.), *Cambridgeport*. The Electrolytic Precipitation of Gold from Cyanide Solutions by the Siemens-Halske Process. (With J. H. BATCHELLER.)
- HARRIS GREENWOOD HOOPER (XIII.), *Brooklyn, N.Y.* Tests with a Towline Dynamometer.
- BERTRAM CORNELIUS HOPEMAN (IV.), *Rochester, N.Y.* A Study for the Structural Design of an Auditorium.
- ROBERT MILNE HOPKINS (VI.), *Evanston, Ill.* Wave Forms of Current and Electromotive Force of Phasing Transformer. (With C. C. BROWN.)
- FRANK NELSON HORTON (II.), *Southbridge*. A Study of the Coefficient of Friction at Different Speeds, between Leather Belting and Cast Iron. (With C. F. SUHR.)
- WILLIAM BALDWIN HOUGH (II.), *Williamsport, Pa.* The Comparative Strength of Standard Screws and Cylindrical Rods of the Root Diameter.
- HERBERT HOLMES HOWE (IX.), *Boston*. The British Soldier in Kipling's Works.
- HERMAN REYNOLDS HUNT (XIII.), *New Bedford*. A Collection and Reduction of Data for the Powering of Ships. (With R. C. SIMPSON.)
- JAMES WHITTLESEY HUSSEY (XIII.), *Toledo, Ohio*. A Towing Test on a Model of the Revenue Cutter "Manning." (With H. A. MACPHERSON.)
- CHARLES CHAPLIN JOHNSON (X.), *Danversport*. The Testing of Protective Paints for Iron.
- DANIEL STEWART JOHNSON (III.), *Short Hills, N.J.* The Refining of Crude Copper. (With E. E. BUGBEE.)
- HENRY DETRICK JOUETT (I.), *Somerville*. An Investigation of Bumping Posts, with a Design.
- WALTER ROBY KATTELLE (IV.), *Auburndale*. A Design for a County Court House.

- HERBERT ORESTES KEAY (II.), *Kingston, N.H.* A Design of a Locomotive Repair and Erecting Shop.
- LEIGH SHELTON KEITH (VI.), *North Easton.* A Study of the Wave Forms in the Three-wire Generators of the Institute Plant at Trinity Place. (With H. LITTLEFIELD.)
- ARTHUR ISAAC KENDALL (VII.), *Somerville.* An Investigation of Certain Bacterial Fermentations occurring in Sugar Solutions.
- WILLIAM ALDEN KINGMAN (V.), *South Framingham.* Some New Salts of Selenic and Telluric Acids, and a Study of their Isomorphism.
- GEORGE WASHINGTON KNIGHT (V.), *Dorchester.* Some Reactions for the Detection of the Oximes, Hydrazones, and Hydrazides.
- GRACE LANGFORD (VIII.), *Plymouth.* An Investigation of the Effect of Dilution on the Color of Copper Solutions, and its Relation to the Dissociation Theory.
- LEWIS MORSE LAWRENCE (IV.), *Nashua, N.H.* A Design for a Small Theatre for a City of about 25,000 Inhabitants.
- ROBERT HOWLAND LEACH (III.), *Brockton.* Concentration of Low-grade Pyritic Ore from Eustis, Can. (With F. W. SNOW.)
- CLIFFORD MILTON LEONARD (I.), *Chicago, Ill.* Design for a Three-hinged Arch for a Train Shed.
- RONDEL MORSE LEWIS (V.), *Malden.* A Study of Certain Reactions for the Detection of the Organic Bases.
- EDITH LILIENCRANTZ (IV.), *Oakland, Cal.* A Design for a Villa.
- FRANCIS CHURCH LINCOLN (III.), *Boston.* The Milling of a Nova Scotia Gold Ore.
- ROBERT ROSS LINGLEY (II.), *Cambridge.* Tests on Superheated Steam.
- FRANK WILLIAM LITTLEFIELD (III.), *Peabody.* The Milling of a Nova Scotia Gold Ore with Special Reference to Chlorination and Cyaniding. (With H. C. PLUMMER.)
- HOMER LITTLEFIELD (VI.), *Troy, N.Y.* A Study of the Wave Forms in the Three-wire Generators of the Institute Plant at Trinity Place. (With L. S. KEITH.)



- FRANCIS HENRY MCCRUDDEN (V.), *Boston*. An Investigation of the Colored Oxidation Products of Diorcinyll Methane.
- FRANCIS XAVIER MCGOWAN (II.), *Lawrence*. An Investigation of the Action of an Independent Condenser Air Pump.
- HERBERT AUSTIN MACPHERSON (XIII.), *Medford*. A Towing Test on a Model of the Revenue Cutter "Manning." (With J. W. HUSSEY.)
- SUMNER MARSHALL MANLEY (II.), *Brockton*. The Effect of Different Initial Pressures on Explosive Mixtures of Gas and Air. (With L. S. SMITH.)
- DANIEL ELLWOOD MAXFIELD (II.), *Amesbury*. The Influence of Moisture on the Transverse Strength of Spruce Timber. (With F. D. WARREN.)
- GEORGE HOUK MEAD, B.L. (X.), *Dayton, Ohio*. On the Deterioration of Paper.
- ARTHUR CLARKE MELCHER (V.), *Newton Centre*. The Constitution of Silver Ammonium Hydroxide.
- CHARLES VAN MERRICK (IV.), *Syracuse, N.Y.* A Design for a Chapter House for a Greek Letter Fraternity.
- ALBERT SYDNEY MERRILL (X.), *Malden*. A Study of the Strength of Mercerized Cotton Yarns.
- GEORGE BARRELL MOODY (XIII.), *Bangor, Me.* The Design of a Mathematical Ship-shaped Solid and the Application thereto of Certain Rules used in Ship Calculations. (With W. I. WYMAN.)
- HAROLD LOOMIS MORGAN (VI.), *Springfield*. A Photographic Method of Recording Wave Forms in a 2,000-volt Circuit. (With W. H. FULTON.)
- MORTON CHURCHILL MOTT-SMITH (VI.), *Honolulu, H.I.* Harmonic Analysis of Alternating Current Wave Form. (With E. G. GALLAGHER.)
- WALTER AUGUSTUS MOULTON (III.), *Dorchester*. The Precipitation of Gold, Silver, and Copper from Cyanide Solutions by means of Zinc.
- NEWITT JACKSON NEALL (VI.), *Philadelphia, Pa.* An Apparatus for the Stroboscopic Study of the Alternating Current Arc. (With M. SILVERMAN.)

- EDWARD NORTH, 2d (III.), *Brookline*. A Study of Lead and of Gold Amalgams.
- HARRY EDMUND OSGOOD (II.), *Chicago, Ill.* An Investigation of the Action of an Air Lift Pump. (With E. H. PITCHER.)
- ISAAC OSGOOD (II.), *West Newton*. The Application and Test of a Condenser as applied to a Wool Drying Machine.
- HORACE WHITCOMB OXNARD (I.), *Norway, Me.* Experiments on the Practicability of Determining the Flow through a Long Pipe Line by Measuring the Loss of Head at a Valve.
- JAMES ALFRED PATCH (X.), *Stoneham*. The Extraction of Tannin from Hemlock Bark.
- CHARLES EDWARD PAUL (II.), *Belfast, Me.* The Relation between Draught and Temperature in Chimneys.
- ARTHUR STEARNS PECK (VIII.), *Wellington*. An Investigation of the Electrical Conductivity of Fused Salts. (With H. M. BROCK.)
- THOMAS EDWARD PENARD (VI.), *Paramaribo, Dutch Guiana*. An Investigation of Resonance in Alternating Current Circuits. (With C. H. HAPGOOD.)
- THOMAS DOANE PERRY, A.B. (II.), *Crete, Neb.* Some Experiments on a Shaft Governor. (With R. G. BURNHAM.)
- WILLIAM GARDNER PIGEON (IV.), *East Boston*. A Design for a City Hall for a Small City.
- EDMUND HENRY PITCHER (II.), *Keene, N.H.* An Investigation of the Action of an Air Lift Pump. (With H. E. OSGOOD.)
- HOWARD CLARK PLUMMER (III.), *Milton*. The Milling of a Nova Scotia Gold Ore with Special Reference to Chlorination and Cyaniding. (With F. W. LITTLEFIELD.)
- JOHN LEWIS PORTER (XI.), *North Adams*. A Design for a System of Sewerage and Sewage Disposal for the Town of Randolph, Mass. (With F. W. WITHERELL.)
- PAUL LEON PRICE, Ph.M. (IV.), *Winterset, Ia.* A Study of the Construction of an Art Museum designed by Mr. G. B. Ford; including Walls, Foundations, Steel Framing, Heating, and Ventilation. (With C. H. STRATTON.)
- WILLIAM PROUDMAN RAND (IV.), *Peabody*. A Structural Design for a Public Library.

- WALTER LOUIS RAPP (IV.), *Cincinnati, Ohio*. A Design for a Governor's Mansion.
- ARVILLE C. REDMAN (I.), *Belfast, Me.* An Investigation of the Power to be obtained at a Tide Mill near Boston. (With C. A. RICHARDSON.)
- ARTHUR ADAMS REIMER (I.), *East Orange, N. J.* A Study of the Tides in Boston Harbor and the Charles River.
- CHESTER AUGUSTUS RICHARDSON (I.), *Pelham, N. H.* An Investigation of the Power to be obtained at a Tide Mill near Boston. (With A. C. REDMAN.)
- PHILIP FRANKLIN RIPLEY, A. B. (V.), *Andover*. The Electrolysis of Pimelic Acid.
- ROBERT PARKER ROBERTS (III.), *Roxbury*. Decomposition of Zinc Sulphate by Heat. (With W. A. DOREY.)
- RALPH ROOT (III.), *East Orange, N. J.* The Smelting of a Copper Ore.
- GEORGE EDMOND RUSSELL (I.), *Woburn*. A Design for a Steel Dam.
- WARREN WILLARD SANDERS (V.), *West Gardner*. An Application of the Friedel-Crafts Reaction.
- ALBERT GEORGE ANTON SCHMIDT (II.), *Chicago, Ill.* A Design for an Ice-making Plant.
- GEORGE OTTO SCHNELLER (II.), *Ansonia, Conn.* The Relative Efficiency of Bearings and Lubricants of a Spinning Frame under Mill Conditions. (With S. P. BROWN.)
- LEWEN FIRTH SEARLE (I.), *Lawrence*. Experiments on the Flow of Water through a Standard Mouthpiece. (With H. M. HARPS.)
- KENNETH SEAVER (I.), *Woodstock, Vt.* A Study of Dredging Machines.
- HARRY TILTON SHAPLEY (X.), *Leominster*. The Sizing of Cotton Yarns. (With C. H. BROWN.)
- CHARLES EDWIN SHERMAN (IV.), *Westerly, R. I.* A Design for a Summer Villa.
- LOUIS WILLIAM SHUMAKER (VI.), *Ortonville, Minn.* A Study of an Electrically Propelled Vehicle. (With W. R. COLLIER.)

- MORTIMER SILVERMAN (VI.), *Allegheny, Pa.* An Apparatus for the Stroboscopic Study of the Alternating Current Arc. (With N. J. NEALL.)
- ROBERT COFFIN SIMPSON (XIII.), *Chelsea.* A Collection and Reduction of Data for the Powering of Ships. (With H. R. HUNT.)
- CHARLES EDWARD SMITH (I.), *Somerville.* An Investigation of the Forces Acting on a Water-pipe at Curves and Dead-ends, and of the Methods of Resisting them.
- LAWRENCE SOUTHWICK SMITH (II.), *Peabody.* The Effect of Different Initial Pressures on Explosive Mixtures of Gas and Air. (With S. M. MANLEY.)
- FREDERICK WILLIS SNOW (III.), *Lynn.* Concentration of Low-grade Pyritic Ore from Eustis, Can. (With R. H. LEACH.)
- FREDERIC WILLARD SOUTHWORTH (IV.), *West Stoughton.* A Bank Building for a City of 600,000 Inhabitants.
- MARCY LEAVENWORTH SPERRY (II.), *Brooklyn, N.Y.* The Efficiency of the Hancock Water Ejector. (With P. R. ZIEGLER.)
- HERBERT RICHARDSON STEARNS (I.), *Dorchester.* An Investigation to determine the Accuracy that may be attained with the Pitot Tube in the Measurement of the Flow of Water through Pipes. (With C. D. THURBER.)
- WILLIAM LEONARD STEVENS (III.), *Somerville.* The Milling of a Nova Scotia Gold Ore, with Special Reference to Concentration. (With L. EMERY, 3d.)
- LEWIS STEWART (IV.), *Trenton, N.J.* A Design for a City Residence.
- WILLARD WILBERFORCE STONE (I.), *Taunton.* A Study of Inverted Siphons as used in Sewerage Works, with a Design for a Special Case.
- CHARLES HEYWOOD STRATTON (IV.), *Springfield.* A Study of the Construction of an Art Museum designed by Mr. G. B. Ford; including Walls, Foundations, Steel Framing, Heating, and Ventilation. (With P. L. PRICE.)
- CARL FREDERICK SUHR (II.), *Chelsea.* A Study of the Coefficient

- of Friction at Different Speeds, between Leather Belting and Cast Iron. (With F. N. HORTON.)
- HENRY HOWARD SULLIVAN (II.), *Brighton*. A Study of the "Slip" and "Creep" of Leather Belting.
- RUSSELL SUTER (I.), *Cambridge*. Design for a Chanoine Wicket Dam.
- HARRY MARTIN THAYER (V.), *Brockton*. The Recovery of Zinc from Pyrite Residues.
- CLINTON DRAPER THURBER (I.), *Attleboro*. An Investigation to determine the Accuracy that may be attained with the Pitot Tube in the Measurement of the Flow of Water through Pipes. (With H. R. STEARNS.)
- PERCIVAL EDWARD TRUE (X.), *Andover*. The Electrolysis of Sodium Chloride Solutions.
- THEODORE CALVIN TUCK (I.), *Haverhill*. Design for a Cantilever Highway Bridge.
- WARREN CHAMBERLAIN TUDBURY (I.), *Salem*. A Plan for the Abolition of Grade Crossings on the Boston & Maine Railroad at Everett, Mass. (With M. E. BROOKS.)
- GEORGE AUGUSTUS TWEEDY (III.), *Downey, Cal.* A Study of Fine Concentration. (With R. H. CLARY.)
- EMIL FREDERICK VOGEL (I.), *Roxbury*. A Design for a Lift Draw-bridge.
- HARRY LESLIE WALKER, (IV.), *Oak Park, Ill.* A Design for a Modern Office Building.
- ARTHUR CLARENCE WALWORTH, JR. (II.), *Newton Centre*. An Investigation of the Friction of Steam in Elbows and Bends.
- FRANK DINSMORE WARREN (II.), *Northboro*. The Influence of Moisture on the Transverse Strength of Spruce Timber. With D. E. MAXFIELD.)
- RICHARD WASTCOAT (I.), *Taunton*. An Investigation of the Effect of Air in Water Mains.
- WILLIAM HENRY WEDLOCK (I.), *Dorchester*. Design of a 200-foot Cantilever Crane.
- IRVING CHAMBERS WEEKS (IX.), *Dorchester*. Trade with France and the Reciprocity Treaty of 1899.

- ARTHUR BURR WHITE (I.), *Allston*. Design of a Ferry Landing Bridge.
- WALTER CUMMINGS WHITNEY (I.), *Newton*. Design of a Curved Chord Railroad Bridge, 300 Feet in Span, to be erected without False Work.
- FREDERICK WHITEFIELD WITHERELL (XI.), *Winchester*. A Design for a System of Sewerage and Sewage Disposal for the Town of Randolph, Mass. (With J. L. PORTER.)
- WILLIAM ISAAC WYMAN (XIII.), *Dorchester*. The Design of a Mathematical Ship-shaped Solid and the Application thereto of Certain Rules used in Ship Calculations. (With G. B. MOODY.)
- PERCY ROLFE ZIEGLER (II.), *Roxbury*. The Efficiency of the Hancock Water Ejector. (With M. L. SPERRY.)

CANDIDATES AWARDED THE DEGREE OF BACHELOR OF SCIENCE DURING THE YEAR 1899-1900

- RUSSELL GILPIN (II.), *Wilmington, Del.* Design of a Brake Shoe Testing Machine.
- ARTHUR LITTLE HAMILTON (III.), *Fond du Lac, Wis.* Precipitation of Gold from its Chloride Solution in the Presence of Impurities.
- EDWARD HERBERT (VI.), *Broad Run, Va.* Test of a Single Phase Induction Motor.
- OWEN LEWIS LEONARD (V.), *Newton Centre*. An Investigation of the Action of the Various Assistants used when Mordanting Wool with Bichromate of Potassium.
- ALBERT FRANKLIN NATHAN, JR. (X.), *Kansas City, Mo.* The Absorption of Oxygen by Sterling Silver.

## EDITORIALS

By coming to Boston during Commencement Week, by accepting the invitation of the Technology Club to be its guest, and by entering with delightful zest into all that concerned the Institute, Dr. Pritchett has indeed been graduated, as he gracefully expressed it, with the class of 1900, and will be formally inaugurated, on the 24th of next October, not as a stranger, but as one of ourselves. The felicitous introduction of the President-elect to the alumni by President Crafts, and Dr. Pritchett's happily worded appeal for their personal friendship, secured that friendship at once and for all time. His manliness, his heartiness, his tact, his genuine interest in every Institute man and every Institute matter brought before him, confirm the highest expectations of his friends, and fully justify the lamentations of those in Washington who must lose in order that the Institute may gain.

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Graduation Day was so unwontedly cool that the simple and dry exercises attending the giving of degrees were less of a tax upon the participants than usual. But, even though favored by the weather and buoyed up by the President's admirable address, it is idle to maintain that the audience was not, as always, bored by the abstracts of theses read; and to be bored is to gain a bad impression. Would it not be wiser to leave a good impression by sparing these ten or more graduates the agony of trying to make the unintelligible interesting, and to ask some man of national reputation to speak in their stead? Then, not only would the audience be no longer wearied, but the graduating class would carry away, in addition to its diplomas, in addition to the affectionate and appreciative words of the President, thoughts, experiences, and inspiration from a new point of view, from that of a man who has reached the top of the stiff hill which they are about to climb, who has "got there," as the slang phrase is, by reason of some

quality of mind and character which cannot but give to his words, especially at so momentous a time, a peculiar weight and power. Such an address at such an hour could scarcely fail of infinite value to a large number of those who hear it.

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The well-executed leading article of this year's *Technique*, on Professor Runkle, startles one anew with its ocular reminders of the growth of the Institute. To the students of to-day these revived pictures of the "sand lot," where is now the Walker Building, look as queer as do the costumes of the men and women figuring so prominently in the picture of the old Mercantile Association Building,—the first home of the Institute,—which *Technique* also reproduces. Boylston Street, with its jostling crowds and its settled air of retail shopperry, to-day would tolerate neither the hoop skirts of 1865 nor the sand lots of 1880.

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But those were snug and simple times, when the whole Massachusetts Institute of Technology was to be found within the Rogers Building and its contiguous dump, adorned with that historic pile, the "Gym.;" with the long-obliterated, one-story "Mechanic Arts" Building (in one end of which, as in a sort of quarantine, were isolated the women students); and with some huge rock specimens, around which meandered a path to suggest to the indulgent eye a sunken garden. Within the Rogers Building itself, of those days, one had but to throw open a door here, and the whole Architectural Department was before him; a door there, and the Civil Engineering Department was comprehended in a sweep of the eye; while by going down a broad stairway, by means of which the man who must now drop himself through a spiral knot-hole could then descend in dignity to the basement, one saw before him, *in toto*, the departments of Chemistry, of Mining, of Metallurgy, and the laboratory of Mechanical Engineering. It is true that, to see the latter, which consisted of one small steam-engine, it was necessary to light a lantern; for this single piece of apparatus had been placed



in the darkest of the many dark passages. What an expansion of the whole college is signified by the fact that the Mechanical Engineering Laboratories alone now cover a floor space of nearly half an acre!

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Jones's restaurant was a feature, now long forgotten, of that primitive day. Jones occupied a sort of loft in the Gymnasium, a loft which, rising out of the "sunken garden" to the true ground-level, was reached by a drawbridge flung from Newbury Street. This was a very Bridge of Sighs to the hungry student, to whom no alternatives to Jones were possible, save a cold lunch brought from home or a distant down-town restaurant. For the bridge led one past the Jones kitchen, fully open to the gaze, and wherein such culinary outrages were committed as to appall the appetite of even a growing youth. From Jones's to Mrs. King's and the Technology Club is an advance no less great than from the lantern-lighted Dixwell engine to the magnificent Mechanical Engineering Laboratories of to-day.

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It seemed a formidable and doubtful step forward when the Gymnasium was sent to Exeter Street, the shops to Garrison Street, and the "New" (afterward named the Walker) Building was erected upon their site. Yet sixteen years thereafter it has been found necessary to put up three more "new" buildings and to purchase land covering nearly the whole square bounded by Clarendon Street, Trinity Place, St. James Avenue, and Stanhope Street. This recent purchase of land, which practically doubles the holdings of the Institute upon what now might be called the Clarendon Street campus,—distinguishing it from the Boylston Street campus,—settles for many years to come the question of removal. Tire as one may of the noise and restricted space of the city, and dream as one may of "glory-crowned heights," as at Columbia, or of academic groves, as at Harvard, a location in the heart of a city for a college—especially for a college of pure and applied science—has many real advantages.

For such a location means accessibility to the vast and ever-increasing circle of suburban homes, brought each year closer to the city's heart, whence students may come to such a college without breaking away, as so many young men cannot, from the family life and interests. It means nearness to libraries, museums, and other re-enforcements of education which are possible only in a city. It means closeness of touch with the great mercantile and manufacturing forces, which are depending more and more for their vitality upon educated men, and upon which the college must ever rely for financial backing as well as for objective stimulus to the work and self-denial of a real education. But, more than all these things, the city habitat for the college keeps that institution quickened, maintains its young men in a healthful atmosphere of work and striving, holds constantly before them high standards of achievement, preserves them from that academic super-saturation which renders the air of the small college town sometimes almost poisonous. All this may savor of materialism; but, of the two alternatives, far better for any young man that he be turned toward hustling usefulness rather than toward cloistral superciliousness.

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Not that the latter state of mind is inseparable from the isolated college planted in a community which wholly loses its identity in that of the institution it shelters, forcing the college to develop in an artificial atmosphere, much after the fashion of a young man who should be reared within the circle of an admiring family, wholly shielded from the hard knocks and frank criticism of that unsympathetic world in which, sooner or later, he must make his way. But the chances are that the higher education, which above all things should be typical of the nation and a leader of the nation, will be a more vital and useful force if it be kept closely within, and at the same time above, the most typical, progressive, and stimulating atmosphere of to-day,— that of our great cities.

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As to the moral danger of the city to young men, that is a fallacy which experience and statistics, as well as sound reasoning, unite

to disprove. Temptations to evil exist everywhere, even in the remotest hamlet; and it is only an Arcadian self-deception to pretend that the country is freer from them than the city. To remove temptation by retreating to the wilderness and ringing a curfew bell is to hide one's head, like an ostrich, fatuously believing that Satan cannot see one. To escape from the possibility of viciousness is absolutely impossible. The weak youth will find vice, and succumb to it, just as quickly in the country as in the city; in many cases more quickly, for he will have less to claim his interest, and will find no excitement — which it is natural for youth to crave — except in the breaking of college rules and moral laws. In the city, on the contrary, with its thousand varied interests and its many legitimate excitements, with courses, too, like those of the Institute, demanding of a young man steady daily application and a wide range of independent thought and action, the chances for moral mischief are reduced to a minimum. It is but natural, therefore, that the general moral tone of the Institute students — despite the fact that they have no proctors but their own consciences — should be exceptionally high.

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A boarding-house life, however, is not an ideal one for a young man. Even though he avoid the mistaken economy of a cold hall bedroom and cheap, poor food, the aims of such a community of "transients" are not high, the friends he makes there are not, as a rule, of the best and most permanent kind, the social development of the youth, which is to play so important a part in his future career, is not there properly provided for. Therefore, it would seem wise that young men coming from a distance should either establish themselves in some suburban town, into whose social life they could readily enter, or should group themselves together, securing thereby the best living for the least money, making certain of a congenial companionship among themselves, and obtaining the social advantage of a much wider circle of friends. Here would seem to be a good field for alumni effort in helping to establish, to maintain, and indirectly to govern student houses, where the young men themselves should exercise censorship over

the house, and should regulate its economy. In this way the undergraduates would obtain, under the most agreeable conditions, not only a higher social life, but also a most valuable training in self-government and domestic management.

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## GENERAL INSTITUTE NEWS

Again the Institute year has closed with its graduation exercises, succeeding the usual two weeks' period of examinations. The conditions of weather were exceptionally favorable; and the reception of President Crafts, assisted by president-elect Pritchett and Mrs. Rogers, was notably successful.

The number of graduates is 178, distributed as follows among the courses: civil engineering, 31; mechanical engineering, 33; mining engineering and metallurgy, 20; architecture, 21; chemistry, 16; electrical engineering, 22; biology, 3; physics, 3; general studies, 5; chemical engineering, 11; sanitary engineering, 4; naval architecture, 9. In addition, five candidates are mentioned in the programme as having received degrees during the year; and twelve persons received the diploma of the Lowell School of Design.

### CORPORATION NOTES

On Friday, June 22, Mr. Augustus Lowell, for twenty-seven years a member of the Corporation and for seventeen years of its Executive Committee, died at his home in Brookline. Mr. Lowell has been one of the most active and valuable members of the Corporation, and has helped the work of the Institute in many ways. An extended notice of him will appear in the October number of the REVIEW.

The 282d meeting of the Corporation was held at the Institute, April 18, 1900, to authorize the purchase of land, in pursuance of negotiations between the Executive Committee and the officers of the Boston and Providence Railroad. It was a source

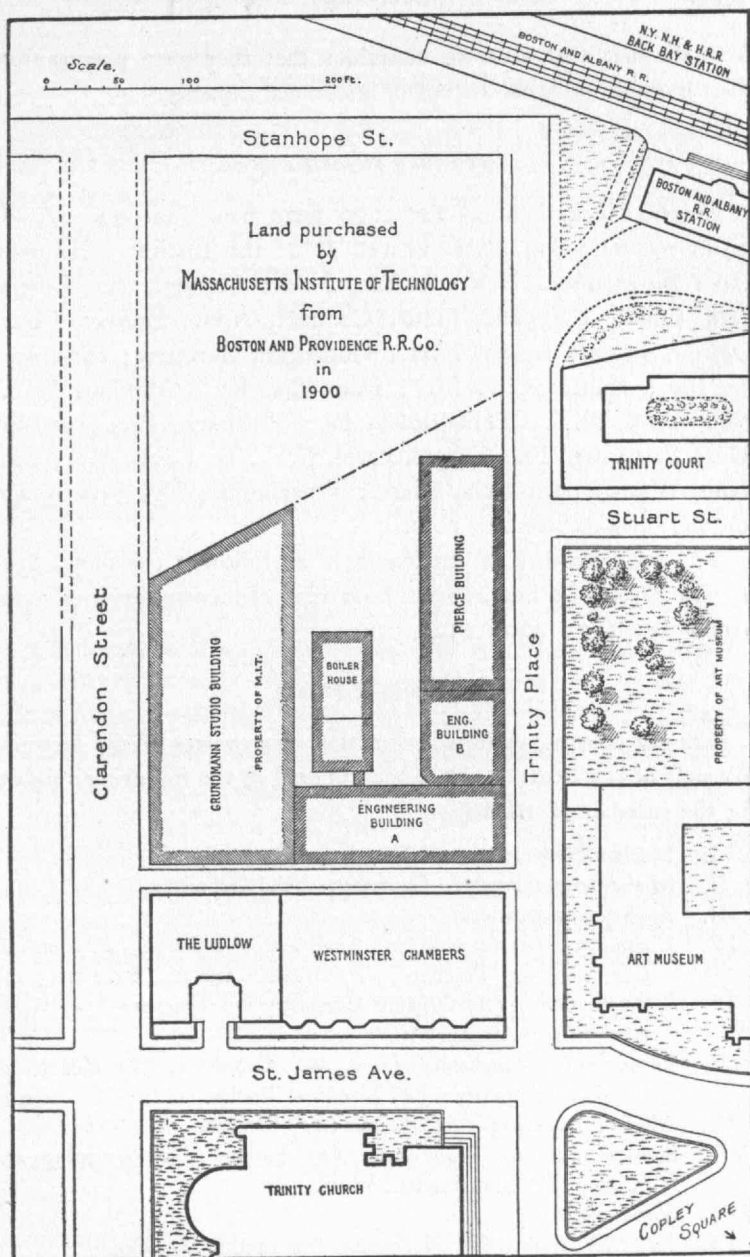
of much gratification to the Institute that it was able to secure land so eligible for future needs. While the reduction of income-bearing funds is regrettable, the opportunity was one which could not be sacrificed. A plan of the new land is given on the opposite page.

#### FACULTY NOTES

The annual meeting of the Faculty for the election of Standing Committees and Secretary was held on Monday, May 7. The Committee on Excuses from Drill becomes, with additional members, a Committee on Military Instruction.

Besides minor changes in the courses in civil and sanitary engineering and biology, important changes have been made in several of the other courses. Detailed schedules have been adopted of the new option in heating and ventilation (of Course II.) and landscape architecture (of Course IV.). A series of five options is offered in the course in chemistry, one including the elements of mechanism, one a considerable proportion of physics, the others following more nearly the present option. On the other hand, a new option in electro-chemistry has been introduced in the course in physics. These changes have led to a supplement to the circular on chemistry and chemical engineering; and to the preparation of a new circular on the department of architecture.

A complimentary dinner in honor of President Crafts, given by the Faculty, took place at the Technology Club on the evening of May 17, no less than forty-five members of the Faculty being present. After the dinner had been served, Dr. Runkle made a brief address, preliminary to his calling upon President Crafts, who responded in his wonted happy vein, which lacked not of the peculiar and delightful quality of wit of which he seems to have a monopoly. One of the most permanent and agreeable impressions to be left by his administration, he said, was the appreciation he felt of the opportunity it had given him for personal acquaintance and friendship with the members of the Faculty,—a sentiment which surely found full sympathy and response in the feelings of his hearers. The evening was an exceptionally pleasant one, largely



from the fact that all were conscious that they were parting from their guest in no sense except in his official capacity.

#### ENTRANCE EXAMINATIONS

Entrance examinations for 1900 were held June 28, 29, and 30 in the following places as well as at the Institute: Belmont, Cal.; Binghamton, N.Y.; Buffalo, N.Y.; Chicago, Ill.; Cincinnati, Ohio; Cleveland, Ohio; Concord, N.H.; Denver, Colo.; Detroit, Mich.; Exeter, N.H.; Göttingen, Germany; Indianapolis, Ind.; Kansas City, Mo.; Louisville, Ky.; Manlius, N.Y.; New York, N.Y.; Philadelphia, Pa.; Pittsburg, Pa.; Portland, Me.; Pottstown, Pa.; Poughkeepsie, N.Y.; St. Louis, Mo.; Spokane, Wash.; Springfield, Mass.; Washington, D.C. Binghamton and Spokane are new points.

The total number of applicants is as follows: complete, 232; preliminary, 244; final, 189. Last year the corresponding numbers were: 217; 260; 152.

#### SUMMER COURSES

Summer courses, under the direction of members of the instructing staff of the Institute, have been offered in the following subjects for the summer of 1900:—

- I. Mechanical Drawing and Descriptive Geometry.
- II. Mathematics: Analytic Geometry; Solid Geometry.
- III. English Composition.
- IV. Chemistry: (a) General and Analytical Chemistry; (b) Inorganic Chemistry for Teachers; (c) Organic Analysis, Reactions, and Preparations; (d) Organic Chemistry for Teachers; (e) Water Analysis and Air Analysis.
- V. Physics: (a) Mechanics, Light, and Electricity; (b) Heat; (c) Physical Laboratory; (d) Electrical Testing.
- VI. Modern Languages: (a) French; (b) German.
- VII. Shop-work: (a) Woodwork; (b) Forging; (c) Chipping and Filing; (d) Machine-tool Work.
- VIII. Surveying.
- IX. (a) Mechanism; (b) Mechanical Engineering Drawing.
- X. Architecture: (a) Shades and Shadows; (b) Elementary Design.
- XI. Geology: (a) Mineralogy; (b) Blowpipe Analysis.



## PROFESSIONAL SUMMER SCHOOLS

The Summer School in Civil Engineering this year has been held at Lake Sunapee, N.H., and has included topographical surveying, hydraulic measurements, and field work in geology. The base line has been measured by means of a steel tape, and the position of certain points has been established by triangulation. The work also included the hydrographical survey of Lake Sunapee. The work in hydraulics consisted in measuring the stream by several methods and gauging meters.

The Summer School of Architecture has been conducted by Professor Homer. Excursions have been made from Boston to Providence, R.I., and to Newburyport, Ipswich, and Cambridge. A week was spent in Providence, where the Rhode Island School of Design gave the use of one of its rooms to the summer school while there; and numerous photographs were taken. Measured drawings were made of colonial architecture.

The Summer School in Mining this year is conducted by Professor Richards, who left Boston on June 8 to visit Dover, N.J., where a study of the methods of mining, hoisting, treating, and shipping the ore was made. A trip was also made to Edison, N.J., where the Edison magnetic plant for separating iron ore was inspected. From Dover the party went to Pottsville, Pa., where a visit to the coal mines was made. It then went to Bethlehem, Pa., where the students had an opportunity of observing the whole process of iron-working from the mining of the ore to the turning out of the finished product at the Bessemer plant and the armor-plate and gun shops. A study was made of the Hokendaqua iron mines, and of the use of the washer as a method of concentration. The other methods of concentrating and smelting iron and zinc ores were studied.

On May 5 the Paris Salon of 1900 awarded the first medal to Mr. Désiré Despradelle, professor of architecture in the Institute. The subject of Professor Despradelle's design is a monument "dedicated to the glory of the American nation," and



is said to be of a grandeur of conception and of a daring in execution almost unparalleled.

Its title, "The Beacon of Progress," indicates the character of the composition, the height of which is designed to be 1,500 feet. The artistic presentation of the project received the unanimous approbation of the jury the day of its admission to the Salon, and the award of the first medal crowns a labor of almost six years.

The awards of the Salon for the section of architecture are two medals of the first class, four medals of the second class, six medals of the third class, and an unlimited number of mentions.

Professor Despradelle received first promotion at the École des Beaux-Arts in 1882; received many of the prizes at the École des Beaux-Arts and Société Centrale des Architectes Français; took part in the Concours de Rome four times, and received first second *grand prix* in 1889, being designated *lauréat du Salon, officier d'Académie*, assistant inspector of State buildings and national palaces, and under this title helped in the building of the new ministry of agriculture, the national library, the mansions of M. Wilson and M. Grévy, the ex-President, and various other public and private buildings in Paris.

Extract from a letter from H. W. Gardner, '94, dated Paris, June 10, 1900:—

About all the "Fair" I have seen has been the Fine Arts Building and our exhibit in the Educational Department, which I hunted up yesterday. It's the swellest exhibition that the department ever sent out; and I know that, when you see it, you will agree with me that at the end of the Exposition it ought to be boxed up and sent home just as it is, frames and all, *regardless* of expense. The location is excellent,—in one of the principal corridors of the gallery, where everybody can see it without any effort, and not in the exhibit proper, which has a room to itself, and into which the people are not apt to go unless particularly interested. It seems to be the only exhibit of a department of architecture from our side of the water, and it's just as well that the others didn't attempt to send any.

Professor George F. Swain, '77, and Professor C. F. A. Currier have appointment as judges for the Hall of Fame, New York University. The whole number of judges is to be one hundred.

At the New England Railroad Club, May 9, two lectures were given, one by J. W. Rollins, '78, on "Arch Construction," and one by Louis Derr, '92, on "Tests of Colored Glass for Signals." Both lectures were illustrated with the stereopticon.

The following letter is taken from the Springfield *Republican* of May 24 :—

My attention has been called to a statement in your issue of the 11th instant, from your special reporter in Boston, under the head "Hard to find Employment," in which he refers to "a well-educated and competent graduate of the Institute of Technology, who is a civil engineer by training, who is to-day selling baking-powder in lack of anything better to do." Possibly, this may not have referred to the Massachusetts Institute of Technology; but, in case it did, I beg leave to ask if you will inform me confidentially who the young man is to whom reference was made. I find by turning to my memorandum-book that since last December I have received between fifty and sixty applications for men, most of whom I have been unable to fill, as I know of no graduates whom I can recommend who are unemployed. If the statement of your correspondence is true, then one of two things is also true: either the young man in question prefers to sell baking-powder rather than to follow his profession, and does not let me know that he desires engineering employment, or else he is not a man in whom I feel sufficient confidence to be able to recommend him to the positions which have offered.

The fact is that there never was a better opportunity in civil engineering work than there is to-day. A good man is certain to find employment, and to be able to make a place for himself; but it is true to-day, as it always has been, that there are few places for poor men. Many a man is dear at any salary in engineering work, and a single mistake may cost his employers more than his entire wages for a year. Men of this kind, in justice to themselves, should not attempt to enter this profession; but there is great need and great opportunity for able, bright young men with an aptitude for engineering. There are graduating from my department every year some thirty young men. These obtain employment without difficulty, and I could doubtless find positions for double as many each year.

GEORGE F. SWAIN.

BOSTON, May 21, 1900.

NOTE.—It has since been learned that the "well-educated and competent graduate" never attended the Institute, and that he earns a large salary by his present labor.

At its recent meeting in New York, Professor Charles Sedgwick Minot, LL.D., '72, was elected president of the American Association for the Advancement of Science. A summary of Dr. Minot's distinguished career will be found in the TECHNOLOGY REVIEW for October, 1899 (Vol. I. p. 463).

On June 27 Dr. Henry S. Pritchett, together with the Secretary of War, received the degree of LL.D. from Hamilton College.

#### SOCIETY OF ARTS

The following papers have been read at the regular meetings of the Society of Arts, January to May, 1900:—

"A New Dynamo Static Machine," by Professor Elihu Thomson; "An Architect's Tour through the Riviera and Central France," by Professor E. B. Homer; "Massachusetts Roads, Old and New," by Mr. W. E. McClintock; "Water Storage on the Gila River, Arizona," by Mr. F. H. Newell; "The Boston Elevated Railway System," by General W. A. Bancroft; "Recent Changes of Opinion in England in Favor of the Bacteriol Purification of Sewage," by Professor L. P. Kinnicutt; "Lecture-room Models for Illustrating the Modern Methods of Electric Transmission of Power," by Professor W. L. Puffer; "Steel, Gray, and Gun Iron Castings, their Uses and Relative Advantages," by Professor W. W. Bird.

At the annual meeting on May 10 the following Executive Committee was chosen to serve from October, 1900, to 1901: George W. Blodgett, Edmund H. Hewins, Desmond Fitzgerald, Charles T. Main, and James P. Munroe. Dr. George V. Wendell was re-elected secretary.

## THE UNDERGRADUATES

## "THE MEDICINE MAN"

On the afternoon of Friday, April 6, the students presented a very ambitious and successful comic opera, "The Medicine Man," at the Hollis Street Theatre, the proceeds going to the support of the Athletic Association. The programme was as follows:—

Libretto by Samuel Merwin      Music by Clarence Dickinson

Mushash, Chief of the Wallahoos . . . . .	JAMES DRISCOLL, '02
Monne Chow-chow, his Medicine Man . . . . .	RICHARD BAKER DERBY, '01
Owandah, a Young Brave . . . . .	MATTHEW CHAUNCEY BRUSH, '01
Peter Simpkins, a Yankee Pedler . . . . .	CHARLES VAN MERRICK, '00
Totem of the Wallahoos . . . . .	ALLAN WINTER ROWE, '01
The Property Man . . . . .	FREDERICK R. C. BOYD, '01
Clover, a Spinster with Hopes . . . . .	LEWIS EMERY, 3d, '00
Naunee, Daughter of Mushash . . . . .	JOHN RANDOLPH BROWNELL, '00

The Scene is the Camping-grounds of the Wallahoos

The time is when you like

## BALLET OF BROWNIES AND FAIRIES

Mortimer Bristol Foster, '01; Paul Hansen, '02; Robert Rishworth Jordan, '03; John Russell Morse, '01; William H. Haskell Moies, '03; Hiram Fred Peaslee, '03; Maurice Goldenburg, '02; and Oliver Porter Scudder, '03.

## GHOST DANCE

Milton Weston Hall, '00; Charles Galloupe Mixter, '02; William Jason Mixter, '02; James Lockerman Taylor, Jr., '02; Francis Blair Driscoll, '01; Arthur Gunderson Hayden, '01; Charles Emmet McCarthy, '02; and Roland Ball Pendergast, '02.

## SOLO DANCES

Lewis Emery, 3d, '00; and Allan Winter Rowe, '01.

## PAS À DEUX

Mortimer Bristol Foster, '01; and Paul Hansen, '02.

## CORPS DE BALLET

Leslie Walker Miller, '01; John Frederick McGann, '01; Edmond Francis Brigham, '00; Harold Arthur Everett, '02; Williard Vaughan Morse, '02; Lawrence Hargreave Lee, '03; Herbert Milton MacMaster, '00; Edwin Francis Albright, '03; Walter Philip Regestein, '03; Ralph Stoodley Loring, '01; Elmer Merrill Hervey, '02; Guy Crosby Peterson, '01; Anthony Winfred Peters, '01; Charles Augustus Barton, Jr., '00; James Edmund Barker, '00; James Finton Doran, '03; George Babcock Wood, '03; Andrew Elliot Ritchie, '01; George William Bateman, '03; Philip Wyatt Moore, '01; Charles Ozro Egerton, '03; Gyula Bennett Mason, '03; Stanley Alfred Foster, '03; and William Whipple, '01.

## CHORUS : BRAVES

F. N. Fowler, '02; I. C. Weeks, '00; S. L. Wonson, '02; W. C. Appleton, '01; J. B. Finnigan, '03; G. F. Loughlin, '03; A. S. Martin, '03; M. Brodie, '02; W. F. Davidson, '01; W. N. Brown, '02; H. W. Maxson, '01; R. W. Eaton, '03; L. B. Gould, '03; E. F. Church, Jr., '01; P. L. Crittenden, '01; A. P. Hall, '02; W. Wellman, '02; G. R. Gaenslen, '03; H. H. Howe, '00; H. W. M. Storer, '03; A. Gardner, '02; G. H. Gleason, '03; R. B. Williams, '03; C. H. Boardman, Jr., '02; A. F. Bennett, '03; and F. W. Witherell, '00.

## SQUAWS

J. R. Marvin, '02; H. H. Sullivan, '00; A. P. Baker, '03; W. M. Drury, '03; G. F. Ashley, '00; E. L. Upham, '02; H. G. Harris, '03; C. Boardman, '02; N. E. Borden, '02; J. S. Bronson, '01; P. R. Brooks, '00; and F. W. McIntyre, '01.

The show was given under the following management:—

Milton Weston Hall, '00, business manager; Allan Winter Rowe, '01, director of stage arrangements; Ray Murray, '01, ticket agent; Henry Hodgman Saylor, '02, assistant business manager; James Bradford Laws, '01, assistant director of stage arrangements; and Charles Walter Corbett, Jr., '01, press agent.

The patrons and patronesses were:—

Mrs. Roger Wolcott, Mrs. Julia Ward Howe, Professor John D. Runkle, Mrs. Louise Chandler Moulton, Professor and Mrs. Charles R. Cross, Mrs. Oliver Ames, Professor and Mrs. Henry P. Talbot, Mr. and Mrs. J. Montgomery Sears, Professor and Mrs. William T. Sedgwick, Mr. and Mrs. W. F. Apthorp, Mr. and Mrs. Henry Austin Clapp, Professor and Mrs. Francis W. Chandler, Dr. and Mrs. John P. Sutherland, Mr. and Mrs. Frederick P. Vinton, Professor and Mrs. William H. Niles, Dr. and Mrs. Samuel J. Mixter, Professor Arlo Bates, Mr. and Mrs. C. P. Curtis, Dr. and Mrs. D. W. Cheever, Professor and Mrs. Gaetano Lanza, Mr. and Mrs. Samuel Cabot, Professor and Mrs. George F. Swain, Professor and Mrs. Dwight Porter, Mr. F. J. Stimson, Mr. Amory A. Lawrence, Mr. and Mrs. W. B. Kehew, Mr. Alfred Hemenway, Mr. Charles Follen Adams, Mr. and Mrs. H. Staples Potter, Mr. and Mrs. A. Lawrence Rotch, Mr. and Mrs. Arthur Foote, and Professor and Mrs. Désiré Despradelle.

The performers were coached by Mrs. Janet Edmondson-Walker. The music was directed by Mr. John Mullaly, and the dancers were trained by Mr. John Coleman. Altogether the performance was not only more elaborate, but, on the whole, more successful than the Minstrel Show of 1899. The dancing was particularly fine; and the acting and singing, while uneven, as is always the case with amateurs, was fully equal to that of other college performances.

#### JUNIOR WEEK

The week of April 23 was enlivened for the undergraduates, and particularly for the members of 1901, by an unusually successful round of Junior Week festivities. The Spring Concert of the Musical Clubs on Tuesday, the Walker Club play on Wednesday, and the Junior Prom. on Thursday evening were, as usual, the main features of the week, supplemented by receptions and spreads on several afternoons. Most important of all, to the mass of the undergraduates, was the appearance, at noon on Wednesday, of the 1901 *Technique*, which achieved an instantaneous success, due in particular to the graceful and witty verses with which it was embellished.

The first important event of Junior Week, the Spring Concert,

was held, as has been the custom for several years past, at Paul Revere Hall. The audience was large; and the greeting extended to the Glee Club, which organization opened the entertainment with a careful rendering of "From a Bygone Day," was an enthusiastic one. The Banjo Club played "A Warm Reception" in a spirited manner, and Mr. H. K. Hooker made one of the hits of the evening with an excellent tenor solo. The Mandolin Club played Henselt's "Liebeslied" with good technique, and added "The Ameer March" as an encore. Messrs. J. A. Patch, C. E. Patch, Whittemore, and Hooker sang "Wake not, but hear me, Love," and "Just a Song at Twilight," arousing considerable enthusiasm; and the Banjo Club ended the first part of the programme with "The Pixie Dance." After the intermission the Mandolin Club rendered the "Infanta Patrol" with grace and delicacy. Messrs. Foster and Boyd played a duet, with "'Rastus on Parade" as an encore, amid much applause. The greatest enthusiasm, however, was reserved for Mr. C. Van Merrick and the Glee Club in the topical song "Predicaments," which dealt with some of the humors of the Institute with marked success. "Elegia," the next selection by the Mandolin Club, was played with skill and real artistic feeling; and the last number on the programme was an original Technology song, the words by Clarence Renshaw, '99, the music by Lloyd B. Harworth.

This latest attempt to satisfy the perennial need for a characteristic Technology song can hardly be considered a conclusive success. The melody is dignified and impressive, but lacks the vigor, the swing, the catchiness which a college song must possess. If only the rollicking verses which Gelett Burgess contributed to the 1901 *Technique* could be set to music which embodied their spirit, the Technology song question would be nearer solution.

The Walker Club Theatricals on Wednesday evening marked a decided and praiseworthy advance over the efforts of previous years. Many Institute men have felt for some time that, although the Pinero comedies produced in the past were amusing and capitally done, it would be more fitting for Technology to be ranged with the more important colleges in combining with amusement



something of real literary value. Professor Bates's choice of a play was a very happy one. "The Miser," in the hands of Plautus, of Molière, and of Fielding, has amused the Greek, the Frenchman, and the Englishman for centuries; and the last version of the three is especially suited for a college performance, because its atmosphere is strong enough to hold the imagination and not so remote as to be unattainable. In spite of all this, it must of course be owned that such a classic play, almost devoid of situation, and depending mainly on the actor's portrayal of character, is a much harder task than a modern comedy, full of "fat" lines and startling complications. The actors, therefore, deserve great credit for the success with which they held their audience and kept them in a ripple of laughter during the whole performance. J. T. Scully, Jr., a star of two years' standing in the Technology firmament, gained especial laurels for his rendering of the title-rôle. Lovegold would be an exacting part for a professional, and the simplicity and reserve with which Scully treated it made an artistic background for his stirring climax at the end of the third act. Next perhaps may be mentioned Beckwith as Mariana, one of the most charming girls ever seen on the college stage. His, or her, conception of La Précieuse, with the dainty, formal affectation of that type, was perfect; and professor, alumnus, and undergraduate alike lost their hearts to her. Appleton as Ramilie, the alert and rascally servant, was capital, and showed the comedian's instinct in every pose and gesture. H. H. Howe, too, as Lappet, played with ease and perception, and was enthusiastically approved by the audience. Of the other principals should be mentioned Hepburn, simple and spontaneous as Clermont; Constantine, a somewhat vehement maiden, but a very winsome bride; Tolman as Frederick, Peters as Mistress Wysely, and Morse as Mistress Wheedle. The play went, throughout, without a single hitch, and the country dance at the close was a happy addition to the original. Altogether, the performance was a pledge that, if the Walker Club keeps up its good work on this line, Institute men will excel in the class of college performances of which "Athalie" was a type, as they have already produced one of the best college comic operas ever seen in Boston.

Of the other events of Junior Week there is but little to be said here. The success of the Tech Tea on Friday afternoon, of the Technology Club Reception to the Prom. guests, and of the Prom. itself, was better appreciated by the participants than described by the reviewer. It should be said, however, that the Prom., of which the matrons were Mrs. Hasket Derby, Mrs. S. J. Mixer, Mrs. Alexander S. Porter, Mrs. A. Lawrence Rotch, and Mrs. George F. Swain, was an unusually brilliant affair in spite of the rival attractions of the Artists' Festival in Copley Hall. It proved, altogether, a fitting climax to one of the most notable Junior Weeks in the history of the school.

#### ANNUAL MEETINGS

At the annual meeting of the Glee Club on April 26 L. B. Haworth, '02, was elected leader, and Claude Patch, '02, was elected manager.

The annual meeting of the Architectural Society was held April 11 in the Pierce Building. The report of the treasurer showed the society to have a balance in the treasury of \$102. During the present year there have been thirty-one men admitted to membership. The following officers for the ensuing year were elected: president, E. F. Lawrence, '01; vice-president, F. N. Emerson, '01; secretary, F. W. Puckey, '01; treasurer, J. C. Fruit, '02; Executive Committee, W. T. Aldrich, '01, F. A. Colby, '01, H. T. Blanchard, '01.

At the annual meeting of the M. I. T. Athletic Association on Friday, April 13, the following officers were elected for the coming year: president, Herbert M. MacMaster, '00; vice-president, H. P. MacDonald, '01; treasurer, Charles A. Sawyer, Jr., '02; secretary, Robert V. Brown, '02; manager, Percy H. Parrock, '01; representative to the Advisory Council, Charles W. Corbett, Jr., '01.

#### ATHLETICS

The Advisory Council recently granted an emblem to the Hare and Hounds Club. The conditions are that, if the club holds at least six runs and a championship run each year, the runs being

over five miles in length, the members who finish within two minutes of the first hound on three-quarters of the runs and the winners of places in the championship run will be allowed to wear a T. H. H. The monogram is to be similar to the T. A. A. now given to winners of firsts in the class and indoor meets. If the club holds a championship run this spring, the winners will be eligible for the emblem.

At the N. E. I. A. A. held at Charles River Park on Monday, May 21, Ray Murray, '01, won the 2-mile bicycle race in 4 m. 36½s.

On April 28 Brown defeated Massachusetts Institute of Technology in track sports by 81 to 54 points, the figures by which Tech beat Brown last year.

The meet was a very successful one. Two Brown records were broken, the hammer throw and the discus throw. The stars on the Brown side were Captain David C. Hall and E. S. Tuttle. The latter, though a Senior, appeared on the track for the first time.

In the 120-yard hurdles, Pope was disqualified for throwing a hurdle. A protest was made by M. I. T. against Hall in the 2-mile run for blocking a runner, but this was not allowed. Wason won second in the hammer throw, but was protested on account of having been at another university inside of a year; and his work was thrown out.

The races were very interesting, and up to the last of the meet the chances seemed even; but, when Brown took all the points in the 2-mile run and the hammer throw, it was seen that she would surely win the meet. The work of Frost, a new man at Tech, deserves especial mention. He ran in the distance events, and made an excellent showing.

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## THE GRADUATES

### WALKER MEMORIAL COMMITTEE

The efforts of the committee and its associates continue to bear good fruit, although particular classes have still much to do. The

status of the subscription at the time of the Alumni Reception of June 5 is shown in the following table in comparison with that at the December meeting. The figures for '68, '78, '85, and '93, are eloquent.

Class.	No. of Graduates.	Amount of Subscriptions.	
		Dec. 29, 1899.	June 1, 1900.
'68	14	\$1,850.00	\$1,850.00
'69	5	25.00	25.00
'70	10	1,260.00	2,260.00
'71	17	70.00	70.00
'72	12	100.00	100.00
'73	26	175.00	200.00
'74	18	85.00	130.00
'75	27	320.00	500.00
'76	43	150.00	150.00
'77	32	175.00	275.00
'78	19	2,750.00	2,750.00
'79	23	1,025.00	1,025.00
'80	8	10.00	60.00
'81	28	150.00	215.00
'82	24	235.00	240.00
'83	19	140.00	510.00
'84	36	800.00	1,150.00
'85	27	2,270.00	2,970.00
'86	59	400.00	835.00
'87	58	350.00	1,785.00
'88	77	500.00	1,425.00
'89	75	1,290.00	1,870.00
'90	102	1,015.00	1,045.00
'91	103	205.00	1,025.00
'92	133	675.00	875.00
'93	129	2,180.60	2,850.60
'94	138	297.50	655.50
'95	144	455.00	765.00
'96	188	85.00	210.00
'97	179	724.00	910.00
'98	199	623.00	793.00
'99	172	—	695.00
Walker Club,		600.10	600.10
Civil Engineering Society,		—	100.00
Former Instructor,		—	50.00
Total,		<u>\$20,990.10</u>	<u>\$30,969.10</u>

## NORTH-WESTERN ALUMNI ASSOCIATION

The *Tech Bulletin* for April, 1900, a one-page paper, issued by the North-western Association, makes the following announcements: "Monthly meetings and suppers are held on the 16th of each month, at 6.45 P.M., at 'The Bismarck,' 180 Randolph Street. When the 16th falls on Saturday or Sunday, the meeting occurs on the following Monday. Summer meetings will be held at 'The Bismarck' Garden, Grace and Halsted Streets, during June, July, August, and September."

"It is our desire to make these meetings popularly scientific or scientifically popular, without disturbing the dry dust of technical erudition or losing the social feature. We want to make them attractive to all members, believing that with our wider sphere of usefulness the Institute will be greatly benefited. The attempt has been highly successful thus far, and we hope it will have the indorsement of our interested friends."

## THE TECHNOLOGY CLUB

The season of smoke talks at the club closed on May 8 with a lecture on Cuba by Mr. Edwin F. Atkins, illustrated with many excellent lantern slides. Mr. Atkins owns one of the largest sugar plantations on the island. The members of the club were treated to an interesting account of that part of the history of Cuba, before and during the late war, which it has been impossible to get from the newspapers. The unbiased account was told in a modest manner, and most intelligently.

The usual light refreshments were served in the dining-room after the members had asked questions about the evening's talk. With this talk, the large attendance, and interest shown by the members, the evening afforded a successful and satisfactory ending of a pleasant season. Already for next year an attractive list of speakers has been planned.

The rooms of the club were used in Junior Week by the Junior Class for a reception to the matrons of the "Prom." It made a

graceful opportunity for those who attended the "Prom." to meet their partners for the dances of the evening.

On Tuesday, June 5, the evening of Commencement Day, an informal reception was given by the club to Dr. Henry Smith Pritchett. Invitations were sent to all members of the club, to members of the Alumni Association, of the Society of Arts, of the Corporation of the Institute, and of the instructing staff. Mr. James P. Munroe, president of the club, Mr. Edwin C. Miller, president of the Alumni Association, and Mr. William Endicott, a member of the Corporation, received with Dr. Pritchett. President Crafts was unable to be present. Messrs. Henry P. Talbot, '85, Frank L. Locke, '86, Edward G. Thomas, '87, Arthur T. Bradlee, '88, William S. Johnson, '89, William Z. Ripley, '90, George A. Campbell, '91, Leonard Metcalf, '92, George V. Wendell, '92, Walter E. Piper, '94, Charles P. Moat, '96, Walter Humphreys, '97, and Paul R. Brooks, '00, as ushers, introduced the many guests to Dr. Pritchett and the receiving party, who stood in the "common room," on the side opposite the stairway. The outside of the club-house was decorated with Japanese lanterns, and the inside with potted plants and cut flowers. Strawberries and ice-cream were served in the dining-room. During the evening it was whispered about that, as it was "Tech" night at the Pop concert, every one was going to Mechanics' Hall later in the evening. At half-past nine a carriage stopped at the entrance of the club; and the President-elect and president of the club were driven to the hall, where many Tech alumni lined up on either side of the middle aisle, and cheered and cheered, enough to rend the roof, as Dr. Pritchett and his escort were ushered up this aisle into a nest of graduates. It was a royal reception.

During this last season the receipts and expenditures have greatly increased,—a fact which shows that the club has been used more than ever. The number of applications for new membership has also increased. The limit of the membership will soon be reached, and a waiting list will be necessary.

## NEWS FROM THE CLASSES

1873.

SAMUEL E. TINKHAM, *Sec.*

City Hall, Boston.

Mr. George H. Kimball, the new chief engineer of the Père Marquette Railroad, was born at Newburyport, Mass., December 8, 1849. He was educated at the Massachusetts Institute of Technology, class of '73. After two years in engineering and surveying, he entered the Motive Power Department of the Pittsburg, Cincinnati & St. Louis as a draughtsman in September, 1875. In April of the following year he was made superintendent of bridges and buildings with the same company. He was superintendent of the Columbus and Sunday Creek Valley, now part of the Toledo & Ohio Central, from October 1, 1879, to January 19, 1880, and then returned to the Pittsburg, Cincinnati & St. Louis as engineer of Maintenance of Way. A year later he was appointed chief engineer of the south-eastern extension of the Toledo, Delphos & Burlington. From October 14, 1882, to Janu-

ary 1, 1889, he was superintendent of the First and Second Districts of the New York, Chicago & St. Louis. He was made chief engineer of the Lake Shore & Michigan Southern on February 19, 1889, and consulting engineer of the same company July, 1891. He continued in this position until September, 1898, when he was appointed superintendent and chief engineer of the Columbus, Sandusky & Hocking. He assumed his present position on March 26.—Alexis H. French has become an associate member of the Alumni Association. He is president of the Boston Society of Civil Engineers for the year 1900-1901.—Shailer & Schnigla, of which R. A. Shailer, '73, is president, were the lowest bidders on the tunnel section of the East Boston Tunnel Work. Their bid was a little less than \$1,000,000, and the work to be completed June 15, 1903. The work done by this company on two sections of the subway was very satisfactory to the subway officials.—



S. M. Felton, who is a member of the M. I. T. Corporation, as well as president of the Chicago & Alton Railroad, was in Boston with the Commercial Clubs of St. Louis, Chicago, and Cincinnati, as was also George O. Carpenter, '73, one of the leading citizens of St. Louis, and vice-president of the St. Louis Lead Company. Mr. Carpenter is a recently elected associate member of the Alumni Association.

1874.

CHARLES F. READ, *Sec.*

Old State House, Boston.

The twenty-eighth annual reunion of the Class Association was held at the Technology Club on January 25, and was attended by a large number of members. At the conclusion of the dinner a business meeting was held, at which the following gentlemen were elected officers for the present year: president, Willis R. Russ; vice-presidents, George H. Barrus and John C. Chase; secretary and treasurer, Charles F. Read.—The Class Association, having voted to hold quarterly

reunions in the form of one o'clock lunches, the first one was held at Marliave's Restaurant, Boston, on April 18, and was greatly enjoyed by all who attended.

1875.

E. A. W. HAMMATT, *Sec.*

53 State Street, Boston.

John C. Sherlock is quite a club man, being a member of six clubs, and has been township treasurer three times. His address is 3875 Clifton Avenue, Cincinnati, Ohio.—F. E. Okie is in the printing ink business, with factory in Philadelphia. His business address is 124 Kenton Place, Philadelphia, Pa.—Amos J. Boyden has recently been in town. He is quite busy with his private practice, and as superintendent of construction for the United States government of the Mint at Philadelphia, Pa.—William R. Webster is going abroad this summer on professional business, and incidentally will visit the fair at Paris.—Some additional subscriptions to the Walker Memorial Gymnasium Fund have recently been received from '75 men. Others are hoped for.

1877.

RICHARD A. HALE, *Sec.*

Lawrence, Mass.

E. C. Woodward, formerly of class of '77, is located at Colorado Springs as assayer and chemist.—John Alden has given an interesting talk in Andover recently before one of the societies on the History of a Lump of Coal.

1882.

WALTER B. SNOW, *Sec.*

Watertown, Mass.

Albert C. Brackett, who was obliged to relinquish his architectural work on account of trouble with his eyes, is now connected with C. K. Amidon & Son, 45 Milk Street, Boston, in the real estate and fire insurance business. His home is at Newton Centre, Mass.—Harry G. Manning was at last accounts in Chicago, putting into operation the enlarged plant of the Simonds Manufacturing Company. He was present at the Cincinnati meeting of the American Society of Mechanical Engineers in May.—A son, Robert Bonney Herrick, was born to Mr. and Mrs. Rufus F. Herrick at Winchester, Mass.,

on May 4, 1900.—Alfred L. Darrow has changed his place of residence to 25 Harris Street, Cambridge, Mass.—Charles J. A. Wardwell, of Laconia, N.H., who was with the class during his Freshman year, has just been awarded an elaborate patent, having no less than forty-two claims, for new form of automatic power-operated knitting machine.—On May 11, J. P. Munroe spoke at Bridgeport, Conn., before the Fairfield County Teachers' Association, on "The High School and the Citizen."—*The American Engineer and Railroad Journal* of May, commending the idea of "lectures delivered by the best non-resident engineers and men of authority that the country affords to engineering students, . . . of which many of our technical schools and colleges are availing themselves," gives among the names of such lecturers those of Walter B. Snow, and F. H. Newell, '85.

1883.

HARVEY S. CHASE, *Sec.*

8 Congress Street, Boston.

George H. Gustin, connected with the Bowker Fertilizer

Company at Elizabeth, N.J., has been successively chemist, superintendent, manager of factories, and "manager of the New York business."—David Wesson sends out a pamphlet of forty pages, setting forth the advantages and uses of the "Wesson Cooking and Salad Oils" made by the Wesson Process Company of New York and Philadelphia. It is stated to be an absolutely pure vegetable oil, and its use is urged in place of lard or butter.

1884.

DR. AUGUSTUS H. GILL, *Sec.*  
Mass. Inst. of Technology, Boston.

Mr. H. F. Baldwin, M. Am. Soc. C.E., engineer of Maintenance of Way of the Erie Railroad, has been appointed chief engineer of the Chicago & Alton Railroad, in place of Mr. H. C. Draper, who will continue with the engineering department of the road.

1887.

EDWARD G. THOMAS, *Sec.*

4 State Street, Boston.

Draper and Sprague made a trip early in the spring to min-

ing properties at Pyramid, Ariz., in which they are interested. Mr. Sprague made an extended trip in California before returning.—H. S. Adams and E. G. Thomas will spend the month of June in California and Colorado, investigating mining properties.—Henry F. Bryant has established a branch office of his firm, French & Bryant of Brookline, at 4 State Street, Boston.

1889.

FRANK L. PIERCE, *Sec.*

31 Milk Street, Boston.

H. H. Hunt has lately accepted the position of manager of the Tampa Electric Company, Tampa, Fla.

1891.

CHARLES GARRISON, *Sec.*

Lexington, Mass.

The annual meeting and dinner of the class of '91 were held at the Technology Club, April 21, 1900. The following twenty-two members were present: Fiske, Forbes, Dart, Young, Campbell, Bird, Dana, Blanchard, Ambrose, Bradley, Palmer, Garrison, Cunningham,

Goodwin, Damon, Tappan, Bryant, Knowles, Hatch, Wilson, Wilder, Douglas. The business meeting was called before dinner by the retiring president, Mr. Cunningham, when new officers were chosen for the next term of three years. Henry A. Fiske was chosen president; Charles Garrison, secretary and treasurer; Harry C. Bradley, assistant secretary. An excellent dinner followed. The menu was cleverly designed by Mr. Bird, who always presents to the class a characteristic sketch to be used on such occasions. His versatility in this line can be seen almost every day by readers of the *Boston Herald*. The dinner passed merrily, and we then took up the annual salary list. The highest of those present was \$6,000; lowest, \$1,200; average, \$2,457. The average last year was \$2,150. Mr. Forbes then spoke at length regarding the Walker Memorial, and succeeded in adding some new names to his subscription list. The members present voted to have a class pamphlet printed in time for the annual dinner next April, for which a subscription of one dollar each

was to be taken from the class. It is good to have it recorded, as memories are apt to lapse when subscription time comes. At about ten o'clock the gathering began to break up, after a most successful meeting. We hope to gather together a much larger representation of the class of '91 at the next meeting, and spread the class fellowship, which is so much appreciated by those who do attend.— Charles W. Hansen died of consumption on April 8 at Santa Fé, N.M. During the past year he has resided in Orange and Santa Ana, Cal. The remains were taken to Chicago for burial. Mr. Hansen leaves a widow and one child.

1892.

PROF. SEVERANCE BURRAGE, *Sec.*

Purdue University, Lafayette, Ind.

Mr. Frederick L. Francis, Course IV., of Fitchburg, Mass., sailed from New York May 26, accompanied by his wife and sister, for a considerable stay in Paris, followed by a short Continental tour.— W. Spencer Hutchinson is at present in Carthage, Mo., to which place he went January 1, to assume

the duties of superintendent of the Boston Get There Zinc Company's mines. He has thus far been engaged chiefly with business matters connected with the company, but is actively pushing the technical development of the property and investigating the feasibility of erecting a concentrating mill.—Arthur J. Ober, of the United States Engineer Corps, who has been located for some time past at Wood's Hole, Mass., has been transferred to Phillipsdale, R.I., where he is supervising certain dredging work that is being carried on in the Pawtucket River. Ambrose Packard is the contractor upon this work.—The wedding of Lawrence B. Manley, of Boston, to Miss Florence I. Everett, of Manchester, N.H., daughter of the late Frank O. Everett, of Worcester, was announced on February 6, 1900.—The marriage of Mr. Richard Waterman to Miss Grace Edna Mathews, at Chicago, Ill., April 28, 1900, was recently announced. Mrs. Waterman is a sister of Dr. Albert Prescott Mathews, '92, Assistant Professor of Physiology in Tufts College Medical School. Mr. and Mrs. Water-

man will reside at 26 Scott Street, Chicago, Ill.—Philip M. Burbank was married June 12 to Miss Annie Mason Bailey, both of Waltham, Mass.—William E. Scales, formerly of Newton, Mass., who will be remembered by many '92 men, was married June 12 to Ella E. Griffin, of Galveston, Tex. They will reside at 1310 Ball Avenue, Galveston, Tex.—Macy S. Pope was elected an associate member of the American Society of Civil Engineers on May 2.—D. C. Heath & Co. have published a book on "School Sanitation and Decoration," the chapters on sanitation being written by Severance Burrage.—The Class Directory was issued in May. Any one connected at any time with '92, desiring a copy, may have one by applying to the class secretary.—The class of '92 was represented by the following men at the reception given to Dr. Henry S. Pritchett at the Technology Club, June 5, 1900: Bigelow, Braman, Derr, Heywood, Ingraham, Marcy, Mathews, Metcalf, Pope, and Wendell.—On June 6 Mr. Francis H. Kendall, of the class of '90, and Miss Lilly Miller, of

the class of '92, were married at Medford, Mass.—George F. Rowell has lately been appointed assistant engineer with the Pennsylvania Water Company of Wilkinsburg, Pa.—The February issue of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* contains an article on "An Apparatus for Testing Injectors," by C. F. Park.—Professor Francis Walker, son of the late General Francis A. Walker, is to head the department of political and social science in Western Reserve University. He has had the same department in Colorado University.

1893.

FREDERIC H. FAY, *Sec.*

60 City Hall, Boston.

The seventh annual meeting and dinner of the class was held at the Technology Club on Saturday evening, March 24, 1900, Vice-President Crosby presiding in the absence of President William B. Page, who could not be present because of serious illness in his family. Following the reading of the reports of the secretary-treasurer,

and of the committee to prepare resolutions upon the death of Herbert W. Stanwood, the Committee on the Technology Club Gift reported the presentation to the club of a silver punch-bowl and coffee-urn. The class voted to pay the Association of Class Secretaries an amount equal to twenty cents for each of our living graduates, a similar contribution being requested of all classes, for the purpose of carrying on the work of the Association. The following officers were elected: president, William W. Crosby; first vice-president, Grosvenor T. Blood; second vice-president, Herbert N. Dawes; secretary-treasurer, Frederic H. Fay; assistant secretary, Charles M. Spofford. After the dinner the club listened to an interesting talk by R. N. Wallis, president of the Fitchburg (Mass.) Common Council, who told of his experiences in politics. C. M. Spofford spoke briefly of the changes that had taken place at the Institute during the preceding year, and also made a statement as to the progress of the Walker Memorial Gymnasium Fund. The last speaker was



S. C. Keith, who presented a paper illustrated by the lantern upon "The Milk Question from the Bacteriological Standpoint." Interspersed with the speaking were a number of vocal selections rendered by J. R. Burke, who is a musician of ability and careful training. One guest and the following members were present: Barton, Blood, Blake, Burke, Biscoe, Cook, Crosby, Cadwell, Dawes, Keith, D. D. Jackson, A. L. Kendall, H. A. Morss, E. S. Page, Pickert, W. T. Peck, C. W. Sawyer, Spofford, Tomfohrde, R. N. Wallis.—Harry Hill Thorndike, formerly a special student in architecture, spent a part of 1898-99 in Italy and France. He is a member of the Veteran Association, First Corps of Cadets, Boston, in which organization he has served over five years; and he belongs, as well, to the Somerset, Athletic, and Country Clubs of Boston.—Walter Woodbury Patch, of Boston, and Miss Alice Winnifred Walker, of Marlboro, Mass., were married April 5, 1900.—Willis T. Knowlton is in Honolulu, Hawaiian Islands, where he has a position as assistant

engineer on the construction of the sewerage system of Honolulu.—Frank Houghton has been made assistant cashier of the National Exchange Bank, Boston.—Philip B. Day, a son of Rear-Admiral Day, U.S.N., was married April 26, 1899, to Miss Ernestine Alberg, of Columbus, Ohio. Day is engaged in stock-farming at Glasgow, Va.—George S. Barrows, of Gloucester City, N.J., engineer for the Welsbach Light Company, was consulting engineer, in charge of the lighting plant of that company, at the National Export Exposition, Philadelphia, in 1899. Barrows is a member of the Military Order of the Loyal Legion, University Club of Philadelphia, Merion Cricket Club of Haverford, Psi Upsilon Club of New York, and the Franklin Institute, Philadelphia.—Since leaving the Institute, S. H. Brockunier has been engaged in a variety of mining works, having reported upon a number of gold and coal mines in Colorado and Canada, in addition to his work as general manager of the Virginia Mining Company of Ontario, Limited, at Rat Portage, Ontario. In 1899 he received from Dickinson College



the degree of A.M. Brockunier has published a series of letters on "Life in Northwestern Ontario." — Charles Winthrop Sawyer delivers each winter a course of lectures on Architectural History before classes of the Boston Y. M. C. A. He is also known as an occasional writer of short stories of adventure.— Dr. Augustus B. Wadsworth, who, subsequent to his graduation in biology with our class, took up the study of medicine and graduated in 1896 at the College of Physicians and Surgeons, New York City, has been assistant in bacteriology and alumni fellow in pathology at the above institution, as well as physician at St. Luke's Hospital, New York City.— Wallace C. Lambert, principal assistant to John R. Worcester, consulting engineer, 53 State Street, Boston, assisted the latter in the design of the steel work for the train-shed of the South Station, Boston's new terminal, which is the largest railroad station in the world. Lambert has also had charge of the design of a considerable portion of the steel work for the new Boston Elevated Railway, now in process of construction.

— F. H. Howland, IX., who is representing the Providence *Journal* in South Africa, has been engaged to take Julian Ralph's place on the staff of the London *Daily Mail* with Lord Roberts's column.

1894.

SAMUEL C. PRESCOTT, *Sec.*

Mass. Inst. of Technology, Boston.

J. Calvin Locke has left the employ of the city of New York to accept the position of assistant civil engineer upon the reconstruction of Dry Dock No. 2, under the United States Navy Department, Department of Yards and Docks, New York Navy Yard, Brooklyn, New York City.

1895.

E. H. HUXLEY, *Sec.*

29 Hampshire Street, Camb'port, Mass.

The subscriptions to the Walker Memorial Gymnasium are still coming in, but slowly. The secretary urges all to subscribe.— Edmund D. Barry was married on June 4 to Miss Catherine Clapp Humphreys, of Dorchester.— The secretary would like to receive letters from

the class members from time to time, giving news of general interest to be published in the REVIEW.

1897.

JOHN A. COLLINS, JR., *Sec.*

55 Jackson Street, Lawrence, Mass.

Allen W. Jackson, IV., was married on March 26 to Miss Mary Elizabeth Balch, of Malden, Mass.—Charles W. Bradlee, IX., has entered into partnership with John E. Chatman for the purpose of selling and installing the Magee warm air and combination heaters. He is located at 93 Kilby Street, Boston.—In a letter from William A. Kent, dated Jolo, Philippine Islands, January 11, 1900, Mr. Kent writes: "I have just been appointed engineer officer, District of Jolo, with instructions to make a road sketch from here to Maiban, the residence of the sultan on the other side of the island,—about fifteen miles, I believe. I shall have to improvise my sketching-board, as we have none on hand. In fact, I believe a self-reading rod and a tripod constitute the sum total of our instruments here."—A. E. Kimberley, formerly

with the Lawrence Experimental Station, Massachusetts State Board of Health, then later with Farben-Fabriken, of New York, has recently returned to the Experiment Station.—Edwin R. Motch was married on May 23 to Miss Ottie May Carpenter of Covington, Ky. Mr. Motch is located in Cleveland, Ohio.—Edward H. Woodworth, V., was married on Tuesday, June 19, to Miss Edith Louise Drury, of Newtonville, Mass.—Attention of the members of '97 is called again to the subscriptions for the Walker Memorial Gymnasium Fund. The total amount given by the class as yet is in the neighborhood of nine hundred dollars. One point of interest is that '97 is among the leaders as regards the number of men subscribing, which fact is hopeful, although we may not have attained a high position as regards amounts. Let those who have not given send in their names either with cash or with promises for the future.—Stanley Howland is at present first lieutenant of Company E, Twenty-fourth United States Infantry, stationed at San José in the northern part of the island of

Luzon. He entered the army as second lieutenant in 1898, during the Spanish War, and was promoted in June, 1899.—The following is taken from the *Springfield Republican* of June 8, 1900: "William Thornton Parker, Jr., of this city died in the Cambridge Hospital of cerebral apoplexy at 3.25 yesterday afternoon, after a week's illness. His death is the result of overstudy, as his ambition led him to take a high stand in the Harvard Law School, from which he would have been graduated in a few days, had he lived. His illness and death have come as a sudden and severe blow to his friends. He was taken ill only last Friday, and there had been no hope for his life from the first. For the three weeks previous to his illness he complained of severe headaches, and consulted physicians about them, urging them to endeavor to keep up his strength until June 4, when his last examination would take place. On Thursday night some of his friends heard a heavy fall in his room, and on entering found him lying unconscious on the floor. They put him on his bed; and he recovered consciousness in a short time,

but soon began to complain that his limbs and face were beginning to feel paralyzed. Slowly he became entirely paralyzed and lost consciousness, and remained in that condition until his death. William Parker was one of the best known and most thoroughly respected young men in this city, and all his friends will sincerely mourn his loss. His mind was exceptionally mature and strong. He was well informed on many subjects, and took an active interest in all current events. For the past seven years he had spent the winters in Boston, while studying at the Massachusetts Institute of Technology and the Harvard Law School; but he had made frequent visits in this city, to be with his family and to attend social functions. His ambition was to become a corporation lawyer in Boston, and his achievements in the schools gave every promise of his chosen profession. An alert student, he would grasp a subject readily, and then hold it with rare tenacity. During the past winter he had delivered three lectures at the School of Technology on municipal government, and had been requested to give more

next winter on constitutional law. This is considered a great honor among the graduates of the Institute, and is a proof of the light in which the Faculty under whom he had worked for four years regarded him. By nature he was a quiet man, who would not show his knowledge unless it was drawn from him in conversation; but then every sentence and idea came clear-cut and to the point. William Thornton Parker, Jr., was the only son of Dr. and Mrs. William T. Parker, and a grandson of the late John B. Stebbins, of this city, and the late Dr. Benjamin Parker, of Boston. He was born in this city in 1876, and spent his childhood in part here and in Newport, R.I. He had travelled extensively, and was familiar with European countries. He was graduated with honors from the Springfield High School in the class of 1893, and entered the Institute of Technology with honors. At the school he was one of the leading men in his class, both in studies and socially. He was a member of the Technology Chapter of the Delta Psi Fraternity, and belonged to several of the social clubs. He was also

a member of the Storey Law Club at Harvard. He was graduated with the class of '97, standing near the head, and then entered Harvard Law School, where he was just finishing his course. In the Law School his career was like that in the lower schools, and he took high rank again. In addition to his studies he became interested in rowing, and was on the Weld law school crew during the three years of his course. When spending his summers in this city, he also rowed, and was a member of the Springfield boat club eight."

1898.—

C. E. A. WINSLOW, *Sec.*

Hotel Oxford, Boston.

G. E. Bergstrom has left Boston to take a position at Neenah, Wis.—C. E. Bray is in the office of the city engineer of Somerville.—E. F. Currier is with the Hamilton Woollen Company of Amesbury, Mass.—W. R. Dodge has been in Mexico this spring on professional business.—G. R. Wadsworth, who is assistant engineer of the Middle Division, N. Y. C. & H. R.R., stationed at Albany, was in Boston early

in May, and talked over old times with some of his classmates.—J. F. Sickman is in the United States engineer's office at Tuscaloosa, Ala.—H. W. Jones, who will graduate from the Harvard Medical School next year, has recently joined the Technology Club.—C. A. Stickney, 134 Nina Avenue, St. Paul, is president and manager of the Charles A. Stickney Company, engaged in the manufacture of gasolene engines.—C. H. Smith is with the Providence Engineering Works as a draughtsman.—W. D. Blackmer is superintendent of the Tornado Mine, Cripple Creek, Col.—J. F. Kelly has an architect's office at 100 William Street, New York City.—G. A. Hutchinson, who spent his first year after graduation in the shops of the Nordberg Manufacturing Company at Milwaukee, has just completed a second year with the same company, devoted to the work of the draughting-room.—Miss M. J. Thomson is teaching science at the Prospect Hill School, Greenfield, Mass.—A. L. Goodrich is assistant chemist with the Union Oil Company at New Orleans.—The reunion of '98

men at the Technology Club on March 27 was a great success. Thirty-one men were present, A. L. Swasey from Philadelphia being long-distance man. The meeting was announced as an informal one, and the term proved appropriate. Another such reunion will be held early in the fall.—R. E. Daly, D.D.S., is practising as a dentist at 10 Tremont Row, Boston, Mass.—'98's record in the Walker Memorial Gymnasium shows a total of seven hundred and ninety-three dollars subscribed by twenty-seven men. This is still nearly a hundred dollars behind '97. '98, this way!—F. L. Twombly is connected with the United Mills and Export Company of New York, and is conducting an extensive flour trade with Porto Rico.—J. G. Coffin and A. A. Blanchard will hold Graduate Fellowships for the ensuing year. Coffin intends to take a Ph.D. at Clark University, Worcester, and Blanchard is to study in Germany.—W. W. Ward is with Ernest Flagg, one of the leading architects in New York, and is doing exceptionally good work.—George B. Pillsbury, formerly a member

of the class of '98, M. I. T., has graduated first in his class at West Point, and is expecting to enter the Engineer Corps of the United States Army. It is claimed that his record is exceptionally strong, the best in a series of years. The following press clippings are in point: "Cadet Pillsbury entered the Academy June 15, 1896." "He stands No. 1 in everything except discipline." (*Lowell Courier*.) "He stands head and shoulders above his class; and an officer remarked not long ago, 'There is room for a dozen men between him and second man.' He decided to enter the Institute of Technology, and, after his graduation from the high school, 'took up the Tech Course.' His year at Tech was of great benefit to him, and he did not regret his failure to secure entrance on the first physical examination." (*Boston Journal*.)

1899.

WALTER O. ADAMS, *Sec.*

1776 Mass. Ave., No. Camb., Mass.

The marriage of H. P. James to Miss C. Maude Jacobsen on May 13 at Waterville, N.Y.,

and of Everett H. Hinckley to Miss Mary E. Frost on May 10 at New Bedford, Mass., is announced.—Arthur Hamilton is secretary of the Marinette Iron Works Manufacturing Company at Marinette, Wis.—Miles S. Sherrill is soon to start for Leipzig, where he will study for two years.—Frank R. Swift left for Europe at the close of the school year. He will return to his position at the Institute in the fall.—J. A. Patch will leave during the summer for Beyrout, Syria, where he will take a position as professor of analytical chemistry for three years.—Lew Emery sailed for Europe immediately after Commencement.—Herbert M. Case is with the General Electric Company at Schenectady, N.Y.—Miss Edna Chandler is teaching at Brunswick, Me.—H. J. Skinner is with the General Chemical Company, Camden, N.J.—Informal class dinners were held at the Hotel Savoy in March and in April. They were fairly well attended, and enjoyable. No more will be held until fall.—Our contributions to the Walker Memorial Fund continue to grow. Nearly seven



hundred dollars has so far been subscribed. Every man should be heard from.—The marriage of Ralph W. Loud to Miss Charlotte L. Richards took place at Weymouth, Mass., on May 3, 1900.

1900.

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Seaver expects to be employed on the Pennsylvania lines west of Pittsburg under Thomas Rodd, chief engineer, with headquarters at Pittsburg.—Dean Hinman is with the city engineer of Taunton, Mass.—H. R. Stearns finds employment on Metropolitan Sewerage Work. E. F. Vogel is employed at Columbia, Ohio, by the Case Manufacturing Company, under W. R. Strickland, '98.—G. C. Gibbs has secured work with the Brown Hoisting and Conveying Company of Cleveland, Ohio.—Russell Suter may be found in the office of the city engineer of Cambridge.—F. W. Witherell has accepted a position with the Massachusetts State Board of Health.—G. E. Russell and C. M. Fosdick will remain at the Institute as assistants in civil engineering.



of the class of '98, M. I. T., has graduated first in his class at West Point, and is expecting to enter the Engineer Corps of the United States Army. It is claimed that his record is exceptionally strong, the best in a series of years. The following press clippings are in point: "Cadet Pillsbury entered the Academy June 15, 1896." "He stands No. 1 in everything except discipline." (*Lowell Courier*.) "He stands head and shoulders above his class; and an officer remarked not long ago, 'There is room for a dozen men between him and second man.' He decided to enter the Institute of Technology, and, after his graduation from the high school, 'took up the Tech Course.' His year at Tech was of great benefit to him, and he did not regret his failure to secure entrance on the first physical examination." (*Boston Journal*.)

1899.

WALTER O. ADAMS, *Sec.*

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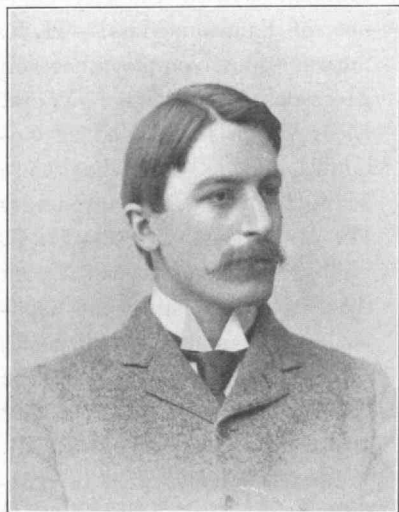
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## NECROLOGY

THURLOW WASHBURN \*



THURLOW WASHBURN was born at the family home in Livermore, Me., on March 16, 1869. His father was the late Charles Ames Washburn, a writer and author, for a time editor of the *Alta California* in San Francisco, and once minister of the United States to Paraguay. Owing to the changes in his father's life and occupations, Thurlow's early schooling was secured with many interruptions, as well as at various places, up to his sixteenth

year, which found him in Andover, Mass. A spirit of adventure and love of outdoor life, which was part of the man's character, seems to have controlled him at this early age; for in that year (1885) he started for Colorado with a friend, Charles Pruden by name, with the idea of building a flat-boat, and floating down the Platte and Missouri Rivers on a voyage of discovery. One can imagine the glowing colors in which the adventures of such a trip through the Far West would be pictured in the mind of the New England boy. The journey to the point of beginning was made, and the boat was

\* In the issue of the TECHNOLOGY REVIEW of last January there appeared in the section of "News from the Classes" a short notice of the death of Thurlow Washburn of the class of 1897. Within little more than two years after graduation, before the fruits of the four years of hard Institute work could be reaped, his career was closed. The associations and incidents of his student life are still fresh in the minds of his classmates and college friends. The circumstances of his death were peculiarly tragic. He died in the courageous performance of duty, which calls for honorable mention and emphasis. For these reasons this short sketch has been prepared for publication in the TECHNOLOGY REVIEW.—A. W.

built; but the voyage was cut short because of lack of water, sand-bars becoming too frequent for navigation to be practicable. Funds were also at a low ebb, and the friend was obliged to seek refuge from the vicissitudes of the voyage of discovery in employment on a sheep ranch. Washburn returned home, but after a brief stay rejoined his friend on the ranch, and shared with him for some little time the hardships and exposures of herding on the plains. The prospects for the future in sheep ranching were, however, not alluring; and this fact, combined, probably, with the revival of the spirit of adventure, stimulated the two friends into a new undertaking still farther west. A small pack outfit and a few horses were gotten together, and a migration south-westward was begun across Eastern Colorado, with Arizona as the ultimate destination, where it was proposed to take up a homestead. Progress was interrupted by a number of obstacles and accidents, which culminated at the crossing of the Rio Grande, near the town of Taos in Northern New Mexico. Here, while attempting to ford this stream where it flowed through a deep canyon, several of the horses were lost; and the young men were left without means of transportation. While waiting here, undecided what to do, they became acquainted with an old American squatter and hunter, who induced them to locate in a little settlement of Americans called "The Lobo." Here they built a cabin, appropriated some land, and started farming. They continued here for six months; but the undertaking did not prove immediately remunerative, while the prospects for the future were poor. Pruden became discouraged, and travelled back east over the Rocky Mountains to the cattle and sheep-grazing country about Springer, and was there again employed as a hand on a sheep ranch. Washburn remained one winter after this in "The Lobo," hunting and doing a little prospecting. He then joined Pruden in Springer; and, with some money which he had, they bought a bunch of horses, and started into horse ranching. Misfortune, however, still seemed to follow them. The herd of horses was maintained for some little time successfully; but, eventually, it was scattered, and in large part lost in a very severe blizzard and snow-storm. This disaster, together with the fact that the price

of horses had fallen to almost nothing, induced the friends to abandon this line of business also. What remained of the lot of horses was gathered together and driven into Southern Kansas, where they were sold, one at a time, to the small farmers. After disposing thus of what remained of the stock, the young men sold the balance of their outfit, and returned East.

About the latter part of the year 1891 Washburn entered the employ of the New York Central Railroad. He first occupied the position of assistant trainmaster on the Mohawk division. Later he was stationed at Buffalo as assistant trainmaster. About the end of the year 1892 he was placed in charge of the construction work of the signal system which was then being installed on the western division. This work, according to all accounts, he performed satisfactorily to the company and with much credit to himself. He was in the employ of this road at the time of the labor strikes in Buffalo, as an aid to Mr. Webb. About the end of May or early in June of 1893, on account of changes in the local management, he resigned from this employment.

In the autumn of 1893 Washburn entered the Massachusetts Institute of Technology, though he had now reached the age of twenty-four years, somewhat late in life to start the study of a new profession. In taking this step, he was influenced largely by the realization that, to gain advance in a technical profession, liberal and thorough education was of first importance. He was further guided at this stage by the advice of a friend, who, writing in testimony of his faithful and efficient work for the railroad company, speaks of having urged Washburn to take this step with the belief that he would be most successful in a life devoted to utilizing natural forces. Undoubtedly, his experience in the Far West, where contact with prospectors and mining men is constant in almost every vocation, had turned Washburn's attention in the direction of mining, and at the same time must have suggested the need of technical education. It was characteristic of the man that, at an age when many young men feel that their career is already unalterably blocked out, he should have recognized the mistakes of his boyhood, and by patient, earnest endeavor have tried to re-

pair what he must have realized he had lost through the interruption of his early education.

Washburn's course at the Institute occupied the full four years. He was graduated in 1897, with the degree of Bachelor of Science in Mining Engineering. While at the Institute, he took active interest and was prominent in class affairs, holding, among other positions, that of Business Manager of the class publications. During the first year of the course, Washburn became acquainted with William C. Potter, a classmate, with whom warm friendship soon sprang up. Both young men selected the mining profession; and, from an early date in their friendship, they began to talk of and to plan for an extended trip through the Western States after graduating. Washburn's early experiences had familiarized him with the ways and means of Western life, and his trials and adversities seemed to have in no wise diminished his ardor for fresh undertakings. Accordingly, at the end of the college course, in the summer of 1897 the two friends met in Chicago, Potter's home, and proceeded thence to Denver. There they bought horses, wagon, and camping outfit, and started westward into the mountains. They first visited Central City; and, after inspecting the mines and mills of that camp, they travelled southward through the Rocky Mountains, visiting almost all of the important mining camps of Colorado. From that State they passed into New Mexico, following, in a general way, the Rio Grande. They finally stopped at a small town called Chloride, which had some years ago experienced a mining boom. They settled for the winter in a cabin in the neighborhood of Chloride, and engaged in prospecting, hunting, and fishing.

In the spring of 1898 Potter entered the employ of the Liberty Bell Gold Mining Company at Telluride, Col.; while Washburn remained in the neighborhood of Chloride, occupied principally in prospecting and developing certain mining claims in which the friends had become interested. Through Potter's association with the company, I was first led into correspondence with Washburn. During the summer of 1898 I engaged him to conduct certain examinations in our interest in the Black Range of New



Mexico, near where he was located. I first met him in November, 1898, at the little town of Fairview, late one evening after a sixty-mile drive in a dilapidated Mexican stage. I well remember the favorable first impression he made. Tall and spare, but of robust build, well hardened and tanned from outdoor life, with frank, open face, humorous twinkle to the eye, and unassuming manner, his was a personality well in harmony with his character, and one calculated to attract and interest at first sight. In conversation he was somewhat slow in expressing himself, but careful and painstaking. Something of the drawl and nasal accent of the "Down Easter" hung by him tenaciously. I spent several days in his company at this time, "batching" in the little cabin where he had established himself, near the mining claims. Here, with a few prospectors as companions, he led the rough-and-ready frontier life, doing his own cooking and housekeeping, sleeping on a rough cot of boards and blankets, with beans, bacon, and biscuits as staples of diet and "canned goods" as luxuries. He was up with the sun, all day at work over the claims, sampling, surveying, or even digging and blasting, with occasional hunting excursions after deer or antelope for recreation. A healthful, active life, with many recommendations and charms for the young man, though not very developing after a certain stage and usually unremunerative.

Washburn continued in the Black Range in the company's employ for about two months after my visit. Then, as the results of his examination failed to recommend the property to further consideration, he was transferred to Telluride. There he first took up the work of assayer, but in the spring of 1899 he was advanced to the position of assistant superintendent. In addition to the routine work of mine and mill assaying, while in the company's employ he gave special attention to the study of the problems of treatment, more particularly with reference to diminishing the loss in the tailings and to increasing the saving in the different stages of the milling. In this work he showed a ready grasp of the problems involved, and proved himself remarkably capable and thorough in devising and working out their solution. Indeed, there seemed to be developing in him, through this work, latent qualities as an in-



vestigator which had lain dormant in past years through lack of incentive or opportunity, and which promised to advance him rapidly in his late-chosen profession. He was in the midst of this work when the end came. The story of his death I have already told in the following words:—

On Thursday morning, October 12, he started on horseback from Telluride to inspect certain work being done for the company on the high mountain range. There was a light snow falling in the valley at the time he started, but nothing serious; and, as an early visit was of considerable importance, after discussing the matter with Mr. Mercer, the superintendent, he decided to go ahead as far as he could on horseback, then turn the horse loose, and proceed on foot. The horse came back about noon of the same day. The storm increased in violence, and continued until Sunday night; but no anxiety was felt, because it was supposed he had reached the cabin, and was waiting there until the storm let up. On Monday Mr. Mercer was preparing to go over the range, when two of the men arrived from the camp, and reported that they had seen nothing of Mr. Washburn. Parties were immediately sent into different basins, and search was continued uninterrupted; but not until Wednesday was the body found, a short distance beyond the Virginus Pass. It appears that he must have been well started down from the pass toward the camp and cabin, almost within shouting distance, when a slide struck him, and threw him headforemost. He was found with about five feet of snow over him and two feet under him. Probably death came quickly, as there were no signs of his having struggled or suffered.

In analyzing Washburn's character, among the most salient traits are tenacity of purpose, courage, loyalty, and devotion to duty. The circumstances of his death strongly emphasize these qualities. The light snowfall of the early morning in the valley must have increased to a condition of some severity even before the horse was turned back; yet Washburn kept on. Before the summit was reached, the storm must have been very violent, and only those who have waded in soft snow against a blinding storm over the rough surfaces and steep slopes of those bleak summits

can realize the severity of the ordeal, or the exertion and determination necessary to gain the pass; yet still he kept on. The visit was important. If the camp was not reached, it would be days and perhaps weeks before another trip could be made. No slight obstacle of inclement weather was to deter him from accomplishing his object. Another who crossed the range, probably somewhat earlier in the day, reported the storm and his own experience as the worst he had ever encountered.

Washburn's mind was, ordinarily, not over-quick to act, but was well balanced and logical; and, though his conclusions might come slowly, they were generally reliable, and were perseveringly and faithfully deduced. In cases of emergency, however, he was capable of prompt action. A friend writes, "I know of several instances in his signal work on the N.Y. C. & H. R. R.R. where, with contradictory orders, blinding snow, and trains off of schedule, his quick judgment and great force have saved serious delays and possible accidents to his own construction train and crew and to the road's regular traffic." His nature, though retiring, was cheerful and social; and he soon became popular, and made warm friends of those with whom he was in contact. He was eminently fair-minded and liberal in both judgment and treatment of others. With him there was no selfish grasping for advantages over associates. His friends unite in testifying to the purity of his life. They also emphasize his quality of stanchness, which permitted no shirking of duty, no matter how severe or disagreeable the condition; and I can heartily join in this tribute. His untimely death has called forth many expressions of sorrow and affectionate remembrance; and in these sentiments I also join, for over and above the feeling of loss of a valuable assistant is the pain of separation from a good companion and loyal friend.

ARTHUR WINSLOW.

KANSAS CITY, MO.,  
June 11, 1900.

## REVIEWS

## DISCUSSIONS IN ECONOMICS AND STATISTICS

BY FRANCIS A. WALKER, Ph.D., LL.D., late President Massachusetts Institute of Technology. Edited by Davis R. Dewey, Ph.D. 2 vols. New York, Henry Holt & Co., 1899.

As President Walker's door was always left ajar, that students of the Institute might enter, so in these two volumes, which comprise some of his representative writings, are we presented with an opportunity to become better acquainted with him. However much we may treasure the memory of his courteous presence and recall the occasions when we learned something of his vigorous mind and his many interests, we cannot therefrom form an adequate conception or appreciation of his real life and character. Even the professors of the Institute, brought in close daily association with him, cannot for that reason claim to know him. He was like a many-sided mountain, and we may all know of him without realizing what is beyond our view. We may think, therefore, of this compilation, fortunately edited by one familiar with the subject-matter and possessing an intimate personal acquaintance with President Walker, as leading us to a vantage-ground from which we may see him better.

Dr. Dewey has selected typical and leading papers from the many which President Walker wrote as essays, lectures, and reports, most of which, but not all, appeared in print during his lifetime, and, after carefully annotating them with portions of other of his papers on similar subjects, has grouped them under the headings: Finance and Taxation; Money and Bimetallism; Economic Theory; Statistics; National Growth; and Social Economics. Within these classifications the papers are arranged chronologically, and each paper is preceded by a brief statement "to indicate the occasion of the lecture or address." References are made to articles bearing on the same subject as well as to the

publication from which the particular paper is taken. Besides embodying representative writings, therefore, these volumes to a considerable extent constitute a bibliography of President Walker's essays, and contain much information by means of which we are kept in touch with the events which formed the *motif*, or impulse, of his discussions. To state the work thus done is to show the labor and the skill necessary for its accomplishment. And that the editor has admirably succeeded in his purpose of giving us, not only "the content" of President Walker's thought, but also "the spirit which characterizes his work," we find upon examining the papers.

The first group, Finance and Taxation, begins with the earliest writing,—in 1868,—entitled "On the Extinguishment of the National Debt, by Poor Richard"; and the first sentences give us the note which sounds clear and true throughout his lifetime of discussion and thought, of straightforward, dignified good sense. He says: "I do not understand that the best way to pay the debt is either not to pay it or indefinitely to put off its payment. The first of these propositions, no matter what its form, is one that gentlemen do not discuss." And, concluding that we should pay our own debt, he observes: "A man may sometimes anticipate his earnings for a good economical purpose. . . . He has no right to leave the world poorer than he found it." As to financial plans, he remarks, "The best way of sinking a debt is to call in and burn the obligations." His opinion that there should be a fixed yearly sum for repayment he submits "to those who believe in the good old fashion of paying honest debts by honest work."

Two years later, in discussing the surplus, he pointed out with equal perception the absurdities in the tariff, such as the tax on drugs and chemicals, and "abominations," such as the salt tax. "We have no right," he says, "to measure the interest of the capitalist class, or even of the able and well-to-do laboring class, against the necessities of the helpless and dependent classes." To an opposite danger, however, President Walker was as keenly alive. "To lay the entire burdens of government upon property," he says in his article upon "The Bases of Taxation," "is a policy

so inequitable as to become flagrantly iniquitous." Deploring also a system of taxation which in reality reduces the income of labor, he considers a tax on "*faculty*, or native or acquired power of production, . . . to be the most equitable form of public contribution." His paper on "Protection and Protectionists" is replete with information and interesting argument, and free from the slightest trace of denunciation, which, he asserts, "should be preceded by a demonstration that it [protection] is socially inexpedient." He points out, however, that the United States itself is "the largest example of free trade mankind have to contemplate," and throws on the protectionists the burden of showing, at least, that the system they advocate may withstand "the well-known fallibility of law-makers and the evil liabilities which beset legislation."

The last of his papers on Finance, that on "Savings-banks," was left in manuscript form, now for the first time printed. It is an admirable statement of the history of savings institutions, particularly in England and the United States, the distinctions between which he accurately defines, showing how the Postal Savings, with its restrictions as to the amount of deposit, is superior to the American banks with their large depositors. Through it all we can see the earnestness with which he desired adequate and safe facilities for the encouragement of small savings and the consequent well-being of the people.

The papers on Money and Bimetallism tell us of President Walker's ideas on subjects in which he was vitally interested and as to which he gained world-wide reputation. They necessarily restate many of the thoughts so clearly set forth in his well-known books on these topics; but they also give us glimpses of his devotion to the principles he so earnestly advocated in the magazines, as a lecturer, as delegate to the Monetary Conference of 1878, and as president of the American Economic Association. He elucidated the quantity theory of money and ably expounded the principles of bimetallism. His position he skilfully defended, and he refused to be misunderstood or misquoted. In an address in the fall of 1896, which he had declined to deliver till after the election, he said clearly, "If bimetallism is, indeed, to be re-estab-

lished for the great objects which have been pointed out, it must be sought through an international agreement." And in a previous paper he denounced inflation as "the greatest danger to the integrity of our national currency," saying, "It should be fought from the start, on the line,—fought tooth and nail, fought to the death."

In the essays on Economic Theory we may find the same determined stand taken after exhaustive research and careful thought. He refused to accept doctrines of earlier writers. Instead of a system of abstractions, he insisted that political economy should be practical and human. Instead of an "economic man," he saw a laborer at his task, providing for the wants of his family; a manufacturer, influenced by changing habits of life and methods of business. Economics he separated from philosophy and theology, and made vital, "growing with the growing knowledge of the race, . . . something to which every man in his place may contribute; to which all classes and races of men must contribute if the full truth is to be discovered; something to which every clime and every age brings gifts all their own; something to which the history of institutions, the course of invention, the story of human experience, are not pertinent only, but essential." With admirable enthusiasm he adds, "In such a work who would not wish to join?"

His ardent individuality is also to be discerned in his attack upon the wage-fund theory, his thesis being that wages are paid from the product of industry, and influenced by the laborer himself. The originality and ability of his exposition provoked widespread discussion and criticism, which, in turn, called from him forceful rejoinders. We must admire his treatment of his critics. Even when accused of grossly misrepresenting accepted doctrines, his reply, though full of fire, was as generous, as dignified, and as carefully planned as were his official reports. Of the subject-matter his treatises on Political Economy and The Wages Question tell us; but the present papers, written without the opportunity for deliberative consideration, in the heat of debate, display to advantage his personal characteristics.



The articles before us relating to Statistics and to National Growth give an insight to President Walker's life in Washington and as head of the American Statistical Association, and show us his great interest in national conditions. As chief of the Bureau of Statistics and as superintendent of the Ninth Census, his success was immediate and far-reaching; and in these pages we can see the reason. He knew how to organize such work, and to him statistics were full of life and meaning. His interpretations of what to many of us would be pages of numbers are masterful. An interesting instance we find in his paper written in 1875 on "Our Domestic Service," which, though strictly not a statistical inquiry, like many other of his writings bears evidence of his statistical method. Speaking of the Southern States, he says: "We should look to see here an access of domestic service, due partly to an accumulation which has not had time to drain off, and partly to the force of habits deeply bred in master and in man. And so we find it. The census statistics show in 1870 there were but 4.29 families, high and low, rich and poor, white and black, to one domestic servant in Virginia; in Kentucky, 5.58; in Delaware, 4.83; in Maryland, 4.03. . . . West Virginia has 11.75 families to one servant. Is anything further necessary, to a student of history, to explain the cleavage that took place during the war in the old State,—the adhesion of the north-western counties to the cause of the Union, while the southern and eastern counties followed the fortunes of the Confederacy, 'whose keystone was slavery,'—than such a contrast as is thus presented in the statistics of domestic service in the two sections of the Virginia of 1860?"

Thus he made statistics most interesting reading, and not only by his ability of presentation, but also by his natural buoyancy and his national pride. In American agriculture he found that "the achievements of those who in this new land have dealt with the soil . . . surpass the achievements of mankind in any other field of economic effort." And, in writing of American manufactures, he says, "The natural resources of the United States, in field and forest and mine, are far beyond those of our rivals, England, France, or Germany, and all of them combined." Yet he was



never carried away by optimism. In 1870 he wrote: "The idea that, after all the tangible elements have been calculated and included, there still remains to be added some vast, undefined amount, all because we are 'a great and growing people,' or that the American eagle by himself is worth fifteen or twenty thousand millions of dollars, must be utterly discarded. . . . The gold and silver, the houses and lands, the railroads and shops, which we hold as the net results of our labor as a people, are worth just as much as the shops, railroads, lands, houses, silver, and gold of the unhappy subjects of absolute or limited monarchies, and no more." Perhaps fittingly his last public address, in December, 1896, was before the American Statistical Association, with which he was so closely identified. In part it was an earnest plea that the United States government should provide, as well as a military and naval academy to prepare men for war, some means of training for the statistical service of the country.

The last group of writings, which the editor has entitled Social Economics, bring us nearer to President Walker personally. His scientific papers abound in interest, and impress us with his store of knowledge and his familiarity with every phase of his discussions. To reread his thoughts is to add each time to our information, and to appreciate more the great zeal with which he worked. Of his writings on social conditions this is also true; but in these latter papers we come in closer contact with him as he was in his every-day life, deeply and humanly interested in the welfare of those about him. A real friend both to the laborer and to the employer, he brought to every dispute, with his clear power of perception, an honest mind and a sympathetic heart. He was never afraid of any socialistic project. "Whatever the programmes of men and societies," he says, "the socialistic movement will cease to determine when it begins to impair or manifestly to threaten the common, homely, every-day happiness and comfort of the masses." Speaking of sanitary inspection and regulation, he says: "For such good as I see coming from this source . . . I would, were it needful, join one of Fourier's 'phalanxes,' go to the barricades with Louis Blanc, or be sworn into a Nihilistic circle."

No one, surely, can quarrel with that; yet "*Utopias* of a few individuals" found little mercy at his hands. Competition he believed in thoroughly, and pointed out the dangers thereto brought about by the industrial corporation, adding as to the latter, "How absurd it is to claim for it the protection of *laissez-faire*!" The evils also of "those industries which in their nature tend to monopoly" he indicated; and he referred to "the rightful and growing — the fortunately growing — ambition and self-assertion of the working classes." But this is as far as he went. Ready to accept the benefit of every legislative act "honestly and prudently conceived to promote the public welfare," and finding in "every real and serious cause of complaint which is removed . . . a fresh occasion for loyalty, gratitude, and devotion," believing we should take account of "the natural aptitudes, the prevailing sentiments, the institutions, great and small, the political and economic history of a nation," in considering socialistic progress, he ever maintained that "the working classes have a real, a large and a vital part to perform in securing that distribution of the product of industry which shall promote the highest development of the industrial organism and at the same time minister to the health and strength of each part and member."

Restriction of immigration he steadfastly advocated, saying: "The question to-day is not of preventing the wards of our almshouses, our insane asylums, and our jails from being stuffed to repletion by new arrivals from Europe, but of protecting the American rate of wages, the American standard of living and the quality of American citizenship from degradation through the tumultuous access of vast throngs of ignorant and brutalizing peasantry from countries of Eastern and Southern Europe." "When was it," he asks, "that native Americans first refused to do the lowest kind of manual labor? I answer: When the foreigner came. Did the foreigner come because the native American refused longer to perform any kind of manual labor? No. The American refused because the foreigner came." And he adds: "All that sort of reasoning about the necessity of having a mean kind of man to do a mean kind of work is greatly to be suspected.

It is not possible to have a man who is too good to do any kind of work which the welfare of his family and of the country requires to be done."

The final paper of these discussions, "The Causes of Poverty," many will remember he used to read at the Institute; and in its words are his tones, his gestures, his earnestness, the charm of his presence. "My tale is told. At the beginning I warned the reader that I had no panacea to offer, no single, simple, sovereign cure for the woes and ills of humanity. We must strain out of the blood of the race more of the taint inherited from a bad and vicious past before we can eliminate poverty, much more pauperism, from our social life. The scientific treatment which is applied to physical disease must be extended to mental and moral disease, and a wholesome surgery and cautery must be enforced by the whole power of the State for the good of all. Popular education must be made more sensible, practical, and useful. The housewifely arts must be taught to girls in the schools, and there the boys must learn to use hand and eye and brain in a close and vital co-operation and co-ordination. Yet still we shall have to wait with patience the slow, sure action of time, the all-healer. The balance of social forces has definitely turned to the side of the less fortunate classes; and the course of events now runs in their favor, and no longer against them. Meanwhile let philanthropy continue its noble work in alleviating the afflictions which cannot be wholly cured, and in binding together rich and poor in ties of sympathy and mutual regard."

We need look no further to recognize the qualities that endeared him to all with whom he came in contact, that enabled him as its President to bring honor to the Institute of Technology, that won for him distinction at home and abroad and the respect and praise of his associates. These qualities we cannot encompass and enumerate. But we can feel them and be glad for his life, and in his writings find ever an inspiration.

WM. HERBERT KING, '94.

## STANDARD POLYPHASE APPARATUS AND SYSTEMS

BY MAURICE A. OUDIN, M.S. pp. 242. Illustrated. New York, D. Van Nostrand Company, 1899.

This volume is a description of apparatus and methods, chiefly American, employed in electric power transmission plants constructed along the lines now considered as representing the best practice. After an introduction containing definitions of the terms used in alternating current working, the twelve following chapters deal with the various types of generators, induction and synchronous motors, rotary and static transformers, station and line equipment, the description and comparison of the different polyphase systems, and the choice of frequency. The final chapter is devoted to the calculation of transmission lines.

The book is intended primarily for electrical engineers, and will be warmly welcomed by them as a valuable addition to the accessible information—at present all too scanty—on a subject of rapidly increasing industrial importance. A considerable part of it is taken from the circulars of the manufacturers of polyphase apparatus; but this rather increases than lessens its value, as the author's aim is to describe existing methods and not to write a treatise on the theory of power transmission. The result is a large amount of useful information in a compact and readable form. Space limitations, apparently, have compressed the discussion of the parallel running of alternators into a few amplifications of the statement that the machines should have a moderate amount of armature inductance: everything else is left to the reader to supply. In considering regulation, no mention is made of the protection which a lagging current affords to an alternator in case of short circuit. If the design of the machine does not permit a flow of more than three or four times the normal amount, in case of accident an element of safety is introduced into the operation of large units which cannot be ignored and which is worth some sacrifice in closeness of regulation.

The chapters on motors are well and concisely written, and the

unsatisfactory condition of the lightning-arrester problem is noted in the discussion of line equipment. The subject of resonance is of increasing practical importance, and merits a fuller discussion. It should also be noted that the power factors used in the calculation of transmission lines are considerably higher than those obtained in general practice.

The book is well printed and the illustrations excellent. A good index adds noticeably to its value. L. D.

#### TECHNIQUE, 1901

The editors of *Technique*, 1901, are to be credited with a most graceful act in dedicating their volume to Dr. Runkle, whom everybody loves. Not content with this alone, they have devoted the earlier pages to an appreciative review of President Runkle's administration, covering the years which marked the development of the laboratories as important instruments of instruction, the years in which it was first determined that the Institute should remain an independent educational factor, the years of financial stress and harrowing worry, and yet the years in which were successfully laid down the lines of action which have served to make the Institute what it is. During this period the work was made ready for the broadening and refining influences of his successors, whose labors have often appeared more productive than the heroic efforts of the earlier days, which, however, not merely saved the ship, but put her on the course where she was to encounter under able handling the pleasant breezes of prosperity. Incidentally, this dedicatory article furnishes the opportunity for a very interesting account of the earlier years of the Institute, when the exercises were held in the Mercantile Library Building on Summer Street and in rooms of a residence on Chauncy Street, and after this of the occupation of the Rogers Building, the construction of the first gymnasium, the "Annex," or one-story building first used for the School of Mechanic Arts as well as for the first biological laboratory.

All this and more of similar tenor give much of permanent value

to the 1901 *Technique*, and this is most certainly true of the very satisfactory and splendidly executed portrait of Dr. Runkle which faces the dedicatory inscription. In general, in its make-up and execution, this number maintains the high standard which we have become accustomed to look for in *Technique*. The most pretentious of the literary features, "Arlo's Inferno," meets with a favorable reception. The quality of the "grinds" shows definite improvement. The board of editors is to be congratulated, and emphatically commended, for so nearly accomplishing the difficult task of suppressing those supposed grinds which substitute venom for wit. The only case which we remember as furnishing a jarring note is the quotation "Egregiously an ass," ascribed to an apparently unpopular member of the Faculty, who curiously enough had never met the class of 1901. Among the novelties are the prize jokes, and also the opinions of *Technique* given by members of the Faculty, who were really interviewed, but without notice of intent to publish.

The book is dressed in Technology colors, and reflects credit on its board of editors.

#### SCHOOL SANITATION AND DECORATION

BY SEVERANCE BURRAGE and HENRY TURNER BAILEY. D. C. Heath & Co. \$1.00.

In no other direction is the awakening of public sentiment of more consequence than in those problems which have to do with the expenditure of money for public schools.

The aim of the volume under discussion is to accomplish this awakening in two directions, in both of which a willingness to incur for school buildings expenses formerly considered unnecessary must be inculcated. The two topics are closely related, for physical as well as mental health is promoted by cheerful and harmonious surroundings.

It must be remembered that this book is a pioneer in a new field, and that it is written for the general public, not for specialists. So that, while it might be easy to suggest a different arrangement or a



different treatment in some cases, it is fairer to look at the general scope of the work.

The subjects considered are in part: the location and construction of school buildings; sanitary problems of the school-house; heating, ventilation, lighting, and cleaning; the school-room furniture and decoration; the responsibility of authorities for right conditions.

Some strong statements are made, not without reason, which should arouse the attention of every parent.

"Probably no country gives less attention to the careful location of schools than our own United States." p. 6.

Nevertheless, "for several years the number of new school buildings erected has been nearly 6,000 per year; and the annual increase in value of school property has been nearly \$14,000,000." p. 12.

"The perfection and care of the sanitary arrangements of a school building or of any building are the measure of the civilization of the community in which the building exists." p. 68.

"The modern school-room is a workshop. It is a study. But it is also a living-room for children, extremely sensitive to impression. Therefore, it should be as beautiful as a favored home." p. 83.

"Our school-rooms are in danger of becoming 'so full of a number of things' that there will be no room for beauty." p. 94.

Such words as these will surely find good soil and bear fruit. It is not upon words only that this little volume relies. There are eighty-eight illustrations, which show more effectively the meaning of the authors.

The reviewer can bear testimony to the fact that it was not pro-pinquity alone which led to the use of so many Indianapolis school buildings for examples. A belief in the value of education, and a willingness to spend money for school purposes, are characteristic of more than one city in the Middle West.

E. H. R.